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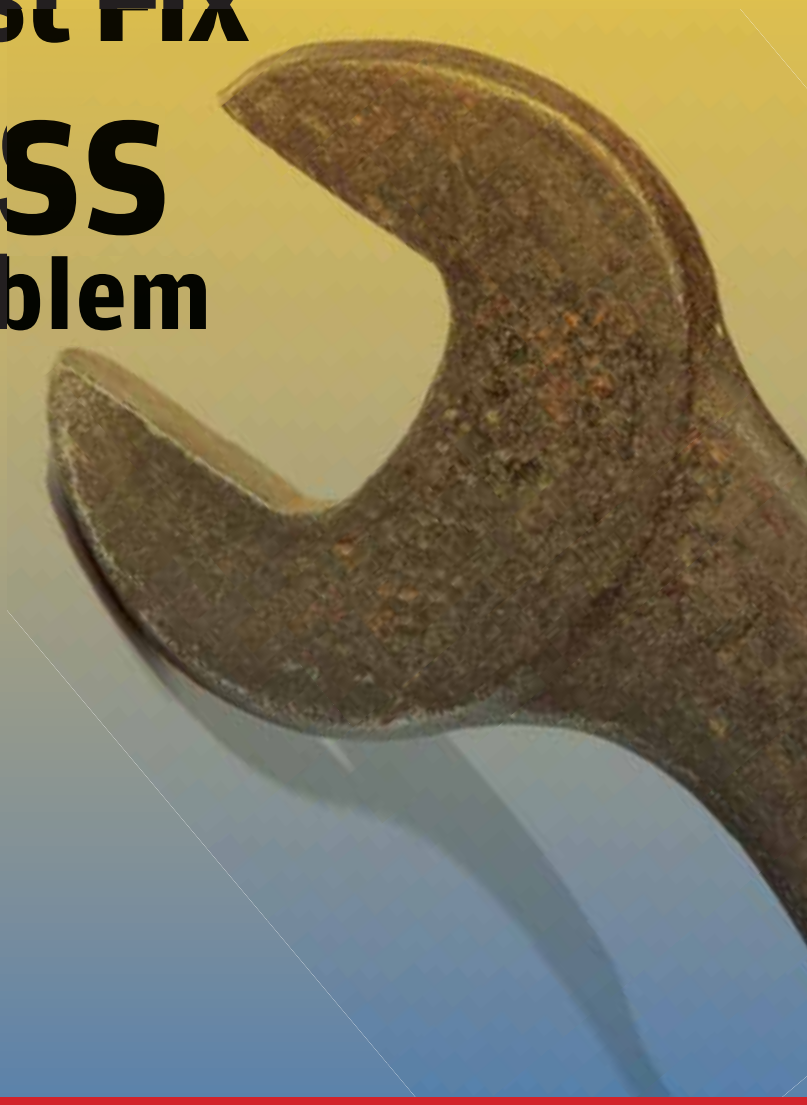
Time To First Fix

Will IRNSS solve the problem



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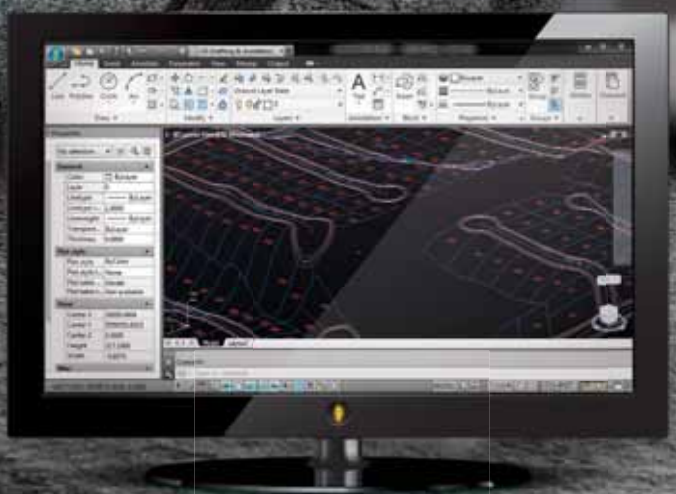

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Time To First Fix
Will IRNSS solve the problem?

This article provides a top level description of methods to achieve fast Time To First Fix (TTFF) and characterizes it using GPS and GLONASS L1 receiver, then generalizes the result for emerging systems such as the Indian Regional Navigation Satellite System

Vyasaraj Guru Rao
University of Calgary, Canada & Accord Software & Systems Pvt Ltd, Bangalore, India

Gérard Lachapelle
Professor of Geomatics Engineering, University of Calgary, Canada

Amongst GNSS receiver design criteria such as accuracy, sensitivity, channels etc., the Time To First Fix (TTFF) is an important criterion, which defines how fast a navigation solution is available to the user since receiver power on. TTFF is defined as the time that a receiver takes to acquire and track a minimum of four satellites and extract the necessary information (ephemeris - primary parameter) from the demodulated navigation data bits. In the past decade, there has been a constant demand from the user community to optimize TTFF specifications. For example, for E911 use, Global Navigation Satellite System (GNSS) receivers integrated as a part of mobile handsets obtain assistance from a base station (terrestrial link) to enhance the TTFF.

This article provides a top level description of methods to achieve fast TTFF and characterizes it using GPS and GLONASS L1 receiver, then generalizes the result for emerging systems such as the Indian Regional Navigation Satellite System (IRNSS). Using an example, the need for Fast TTFF in single frequency mode of operation is illustrated. A brief overview of receiver operations is first presented from a TTFF perspective.

Receiver Operations leading to TTFF

The signal emerging from GPS satellite and available on the user antenna can be modelled as [1]

$$\boldsymbol{r(t) = Ac(t)d(t)\cos(2\pi f_c t)} \qquad (1)$$

where
A – Carrier power of the transmitted signal
$c(t)$ – Ranging code, chipped at 1.023 MHz
f_c – Signal transmission frequency 1575.42 MHz, BPSK signal
$d(t)$ – Navigation data transmitted at 50 Hz rate

At a top level, the receiver needs to solve three unknowns in position - latitude, longitude and altitude and receiver time, based on the measurements performed on the signal Eq. (1). Typically, the measurements within a receiver are generated from a relatively inferior grade oscillator in comparison with the onboard atomic clock [2]. To facilitate position estimation, measurements need to be synchronous to the satellite clocks, which necessitate the estimation of the local clock misalignment [3]. With this as the fourth unknown, position and time solution mandates measurements to four satellites for navigation estimation. Based on measurements to four satellites, a user position solution is obtained.

The Radio Frequency (RF) signals from the satellites incident on the user antenna are processed in the RF down conversion of the receiver, which generates suitable digital Intermediate Frequencies (IF) for further baseband processing. Signal detection and measurements are performed on the baseband signals. Detection involves estimating the signal in code and Doppler dimension and measurements, in the estimatio of pseudorange and range rates. In addition, the Navigation (NAV) data obtained from the detection process enables the receiver to estimate the satellite position. This along with measurements enables

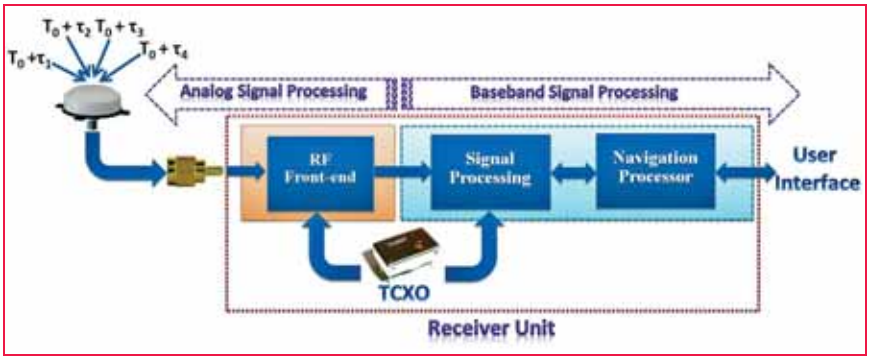

Figure 1: Functional blocks of a typical GNSS receiver from antenna to navigation output

navigation solution estimation. The TTFF consists of operations from processing the signal incident on the user antenna leading to position computation post power-on.

A GNSS user whose primary objective is to obtain the navigation solution would require it immediately from power-on. The need for fast TTFF is a major specification of handheld and critical military applications. The following section explains in detail the various methods practised in industry to enhance TTFF.

Fast TTFF methods – Without external assistance

Based on the inputs (ephemeris, almanac, user position and time) available at power-on, a receiver is categorized into four different modes - Cold, Warm, Hot and Snap. The following paragraph explains each mode of receiver operation and its achievable TTFF.

Cold start

In this mode of operation, a receiver has no prior inputs available within the receiver. With power-on, the receiver needs to search for satellites available from the entire constellation. Subsequently, the system time estimation, measurements to four satellites and NAV data collection are performed. For GPS L1, this process takes 32 to 36 s assuming the initial search is based on fast signal acquisition algorithms [2].

Warm start

These receivers have access to satellites' almanac, approximate user position and time as shown in Figure 2. They are either supplied externally or maintained internally in the receiver. In the internal configuration case, the time at the last power cycle is maintained and estimated typically in Real Time Clock (RTC). Similarly, user position and almanac are maintained in non-volatile memory of baseband processing section. The advantages of these parameters are twofold: First, the receiver will be able to compute the list of visible satellites and restrict the signal detection to those fewer satellites (than complete constellation) that are actually above the horizon. Second, with the almanac, the receiver will be able to compute approximate satellite position; with such an approximate user position, the geometric range can be established. This results in a reduced search range in the code and Doppler domain, which enhances acquisition time. Subsequently, the remaining operations leading to TTFF is similar to cold start and takes 32 s.

Hot start

In addition to the warm start estimates, with a valid ephemeris at power-on, TTFF reduces to 6-8 s and this mode of operation is termed as Hot start [1]. With ephemeris, the only parameter that needs to be established is the system time. Typically, this mode is adopted in most automotive grade receivers.

Snap start

The last mode of receiver operation is the Snap start where, in addition to Hot start parameters, the receiver clock is also estimated internally. The advantage with this approach is further reduction of system time estimation. With bit synchronization established on four satellites, TTFF is achieved instantaneously. This mode assumes that the receiver was powered on recently [2].

Fast TTFF – Assisted GPS (AGPS)

The various start modes assumed receivers have the necessary information stored as a part of its internal memory or assisted from external network, the former

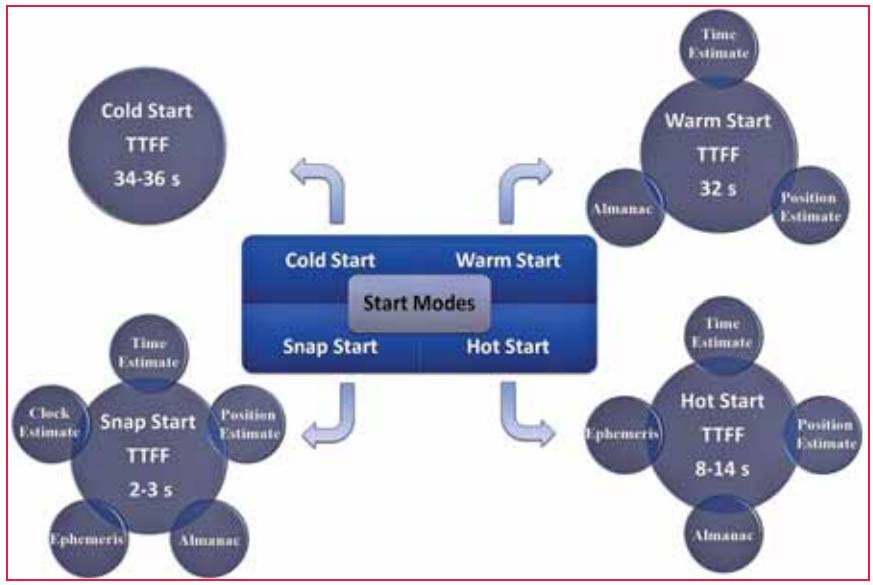

Figure 2: Receiver start modes presenting the estimates available at power-on and achievable TTFF

being receiver specific, the latter being addressed by AGPS. AGPS works on the principle of client server architecture, with the receiver (handset) operated as client. Based on the levels of service offered, AGPS can be categorized as: Ephemeris Assistance and Absolute [2].

Ephemeris assistance is similar to the Hot start mode of operation. With a link to the server, the receiver will be able to obtain approximate position, time and ephemeris. Subsequently, the receiver operations are similar to Hot start with an achieved TTFF of the order of 6-8 s. This mode assumes the receiver to have a constant link with the server, synchronize to the network and thus be able to predict the code and the Doppler search ranges precisely. The absolute mode of AGPS is similar to the Snap start mode of receiver, which provides the TTFF in 2-3 s. However, the load on the server is higher in comparison with the ephemeris assistance mode [2].

TTFF characterisation

With the details of receiver start modes, the next step is to experimentally understand the TTFF from power-on and quantify various parameters underlying it. Towards this, the experimental setup shown in Figure 3 is employed [4].

Test apparatus

The apparatus consisted of a GPS-GLONASS receiver from Accord Software & Systems Pvt Ltd, which was used as a platform to profile various receiver parameters. The receiver supports 32 GPS and 14 GLONASS channels. The receiver does not have the provision of storing or estimating any parameters from previous power-on or hardware to support external data.

Procedure

The receiver was connected to a GPS GLONASS antenna, placed in a surveyed location under open sky. A Digital Storage Oscilloscope (DSO) is connected to the boot-pin of the Digital Signal Processor (DSP) to profile the application boot time

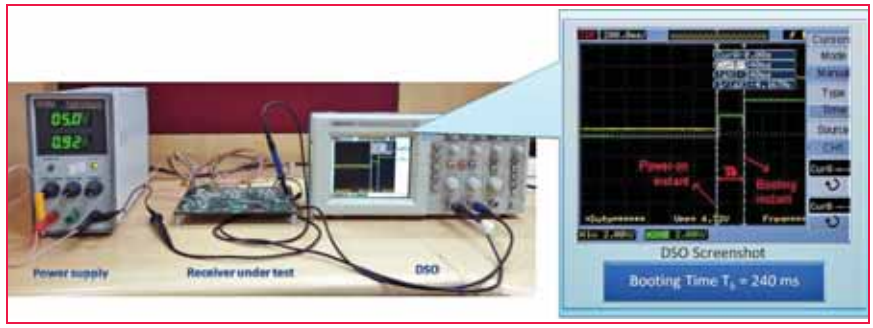

Figure 3: TTFF characterization test apparatus highlighting the boot-time captured on DSO.

(time required to load the software to DSP post power-on). The boot-time with this receiver is around 250 ms, as shown in Figure 3. Generalizing this component, let,

T_b be the time taken to boot the receiver application (2)

Subsequent to booting, the receiver is programmed with 32 GPS and 14 GLONASS satellites to respective channels for further processing. The satellites visible at the receiver antenna take between 2 to 8 s for signal acquisition. This is due to the large Doppler search range supported by the receiver. Generalizing this component, let

T_a be the time taken to acquire the visible satellites (3)

Subsequent to acquisition, each channel takes a finite time for bit-synchronization. This is around 800 ms. Generalizing this component, let

T_{bs} be the time required for bit-synchronization (4)

The next activity on each of the bit-synched channel is the collection of NAV data, specifically the ephemeris. This takes anywhere between 18 and 30 s for GPS and 8 and 30 s for GLONASS channels, respectively. Let,

T_{eph} be the time required to collect ephemeris. (5)

Finally, from the NAV data extracted and the measurements formulated, the user position is computed. Using Eq.(2) through Eq.(5), the TTFF for any Lone of Sight (LOS) receiver is given by

$$TTFF = T_b + T_a + T_{bs} + T_{eph}. \quad (6)$$

Subsequently, for each tracked channel, the almanac is collected, which takes 12.5 minutes from the instant of the first tracked channel in case of GPS and 2.5 minutes in the case of GLONASS. Generalizing this component, let

T_{alm} be the time taken to collect almanac (7)

Following the almanac collection, the receiver applies the ionosphere correction to the pseudoranges to improve accuracy. Accounting for this correction, the overall timing equation of the receiver is given by

$$T_{posc} = T_b + T_a + T_{bs} + T_{eph} + T_{alm} \quad (8)$$

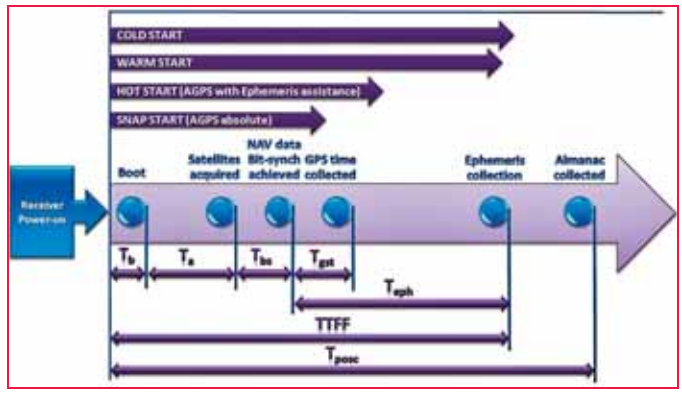

Figure 4: Timing diagram of TTFF characterization capturing all the components and parallel drawn with AGPS mode of operation

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Table 1: Distribution of receiver components leading to TTFF

Parameter	Description	Time taken (%)
T_b	Booting time	1
T_a	Acquisition time	18
T_{bs}	Time for Bit-synch	2
T_{eph}	Ephemeris collection time	79

Figure 5: Positioning in deep forests without aid to terrestrial link

Based on 50 trials, the above timing components are profiled and tabulated in Table 1. Figure 4 summarizes the various timing components of a generic receiver.

Analysis

Assuming the user receiver has a massive correlator architecture (((1023 correlator/C/A code chip)/channel), acquisition of the signal and bit synchronization occurs approximately in 2 s for all the channels. It is evident from Table 1 that the major component underlying the TTFF for an open sky user is which needs to be reduced to achieve fast TTFF [4]. Generalizing, in order to minimize TTFF, achievable from satellite should be minimized.

Need for fast TTFF

Subsequent to TTFF analysis, studies were carried out on the ICD and the data sheets of selected civilian and military receivers to establish their TTFF for single and dual frequency operation. In addition, there is no documentary evidence describing the sequence of operation or assumptions with which a military signal receiver operates from power-on leading to TTFF. The datasheets of receiver manufacturers supporting military signals are the sole means to access related TTFF performance.

Assuming this number represents the best achievable TTFF for All In View (AIV) architecture, military signal cold starts are at most comparable to civilian ones.

The following describes an example highlighting the limitations of the LOS TTFF achievable in single frequency. A user with a handheld unit would expect it to output position immediately from power-on. In the scenario shown in Figure 1, it is not practical to have a terrestrial link. This requires that the TTFF achievable from the satellite be minimal.

However, from a single frequency perspective the existing (GPS and GLONASS L1) or the emerging (GPS L2C, GPS L5 and GALILEO) systems are not optimal w.r.t TTFF. With some improvements in FNAV method of NAV data transmission in GALILEO, the TTFF is reduced in dual frequency [5].

The above shows how the TTFF of the IRNSS might be enhanced in order to lead to better performance. IRNSS a regional system, the benefits should be derived in single and dual mode of receiver operation [4]. In addition, if an additional frequency to the existing proposed L5 and S1 of IRNSS is added, it can assist the TTFF of GNSS in AGPS/HOT start mode of operation [6]. The parameters to be established are given in Table 2.

Conclusion

This article described the top level operations of a GNSS receiver leading to position estimation. The methods employed within a receiver and using AGPS external assistance to enhance signal acquisition and reduce the TTFF were introduced. The

Table 2: TTFF design parameters to be established for IRNSS

Service / Frequency	TTFF (IRNSS)		Hot Start of GNSS using IRNSS
	Civilian	Military	
Single	?	?	?
Dual	?	?	

analysis of TTFF w.r.t various receiver parameters were presented. It was shown that the TTFF is largely dictated by T_{eph}. Using a real world scenario, the need for an effective LOS TTFF from the satellites was illustrated. TTFF being a design parameter for any GNSS system, the article presented requirements under different mode of operation for civilian and military cases that will assist in establishing optimal IRNSS TTFF parameters.

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Responding to the Great East Japan Earthquake

Geospatial Information Authority of Japan (GSI), the national mapping organization in the Japanese Government, conducted various activities in response to the Great East Japan Earthquake which occurred on 11 March 2011. This article summarizes the activities as well as achievements and challenges recognized

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Geospatial Information Authority of Japan (GSI) conducts national surveying and mapping administration. Historically, it dates back to 1869 when the Cadastral Registration Map Section was established in the office of Geography Department, Ministry of Civil Service. Later in 1888, it was reorganized as Japanese Imperial Land Survey, and then it became the Geographical Survey Institute in former Home Ministry in 1945. Its official English appellation was changed to 'Geospatial Information Authority of Japan' in April 2010.

Main measures and activities of GSI are:

- Observing and providing positional information (longitudes and latitudes) of land and elevations from the mean sea level, with ground control point infrastructure including GNSS Earth Observation Network System (GEONET);
- Providing and publishing base maps (1/25,000 topographic map series etc.), thematic maps (land use map, etc.), DEM as well as aerial photographs, by paper, digital and web-mapping formats; and
- Executing the Survey Act and the Basic Act on the Advancement of Utilizing Geospatial Information (i.e., Japanese NSDI law), jointly with relevant government organizations.

The headquarters are located in Tsukuba city, Ibaraki prefecture, 50 km northeast from Tokyo, the capital of Japan. GSI has ten regional survey departments to implement activities at the regional level. The number of staff members is 711 in 2012. The delegated budget (including both human and capital cost) in fiscal year 2012 was 10.2 billion yen (ca. US$ 130 million).

In Japan, the Disaster Measures Basic Law was established in 1961 as a national framework for measures against natural disasters. Being designated as one of the responsible administrative organs under the purview of Law in 2001, GSI has developed its Disaster Management Operation Plan. The Plan describes the principles of measures and activities in the disaster operation cycle. According to the Plan, GSI has established the Disaster Management Operation Manual and Business Continuity Plan (BCP), which prescribes mobilization of the organization in disaster response phase.

Establishing rules and manuals is not the only assurance of a good performance during an actual disaster response. A number of drills have been regularly exercised in Japan at all levels to establish quick responsiveness and resource mobilization. GSI also conducts similar drills organized by the national government and themselves several times a year. Major GSI's disaster response experiences prior to the Great East Japan Earthquake were: Great Hanshin-Awaji Earthquake (1995), Mt. Usu volcanic eruption (2000) and Niigata-ken-Chuetsu earthquake (2004).

Great East Japan Earthquake

The 2011 off the Pacific coast of Tohoku Earthquake, the main shock, occurred at 14:46 (JST: Japanese Standard Time) on 11 March 2011. The epicenter was located

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about 130 km ESE from Osika peninsula, Miyagi prefecture and 24 km in depth (JMA, 2012). The hypocentral area of the earthquake in the boundary between the Pacific plate and the continental plate extended 400 km in N-S and 150 km in E-W directions. Moment magnitude (Mw) of the earthquake was estimated at 9.0, which is the largest in Japanese observation history and the fourth largest in the world since 1900 (USGS, 2012). Terrible shakes were felt in large areas of the country. It also brought the huge tsunami which washed victims and properties away. The total number of dead and missing as of October 2012, amounted to 18,649 (NPA, 2012). Most victims were in Iwate, Miyagi and Fukushima prefectures. More than 90% of casualties were caused by the tsunami. Buildings and infrastructure were almost destroyed in the tsunami stricken areas.

The disaster triggered a severe accident at the Fukushima Daiichi Nuclear Power Plant. Because the ECCS (Emergency Core Cooling System) of the Plant got damaged and didn't work, nuclear reactors were affected by the melting nuclear fuel, causing the emission of radioactive materials into the environment. Many residents around the Plant had to evacuate to avoid radiation exposure and have been enduring a difficult life since then.

Thanks to the completion of the base isolation (earthquake-free) system in December 2010, the main building of GSI headquarters was unharmed. Those in the organization were safe. Among 1,240 GNSS-based control stations throughout the country, one station was totally washed away and two stations were damaged by the tsunami. In addition, GSI's Soma tidal station in Fukushima prefecture was totally devastated by the tsunami.

Response management

GSI entered into emergency status and set up emergency headquarters (EHQs) immediately after the main shock. EHQs served as the decision making body during the disaster operation. The first EHQs meeting was held at 15:10, on March 11 (JST), just twenty four minutes after the main shock. Chaired by the Director-General of GSI, executives discussed and decided the necessary actions to be taken in EHQs meetings. Figure 1 shows the summary of GSI disaster response activities.

It also dispatched its liaisons on 24-hour per day basis for two months to relevant government organizations in order to identify the needs of geospatial information and provide GSI's products. Further, GSI sent its liaisons to local disaster operation centers to deliver geospatial products for use in field operation. Major disaster response activities are described in the following sections.

Ground surface movements

After the main shock, GSI tried its best to get initial results of ground surface movements detected by GEONET, which consists of 1,240 GNSS-based control stations and the central analysis unit. After a week, it revealed that Osika station, closed to the epicenter of the main shock, moved 5.3 m eastward and subsided 1.2 m, the largest movement ever observed by GEONET (Figure 2 and 3).

It is notable that a large post-seismic slipping movement occurred after the main shock. This post-seismic movement amounted to 101 cm at Yamada GNSS-based control station in Iwate prefecture by September 2012. The total energy released during the movement was estimated at 8.62 at the scale of moment magnitude (Mw) (GSI, 2011b). This movement made decision making difficult in justifying the timing of determination and announcement of new geodetic results in affected areas (Yamagiwa et al., 2012). GSI also detected surface movements by applying SAR (Synthetic Aperture Radar) interferometry (InSAR) method. Original data captured by PALSAR sensor was loaded on ALOS (Advanced Land Observation Satellite) by JAXA (Japan Aerospace Exploration Agency). As shown in Figure 4, surface movements detected by InSAR analysis were concordant with those detected by GEONET (GSI, 2011c).

Aerial photo survey

It is imperative for geospatial organizations to take quick action in acquiring imagery

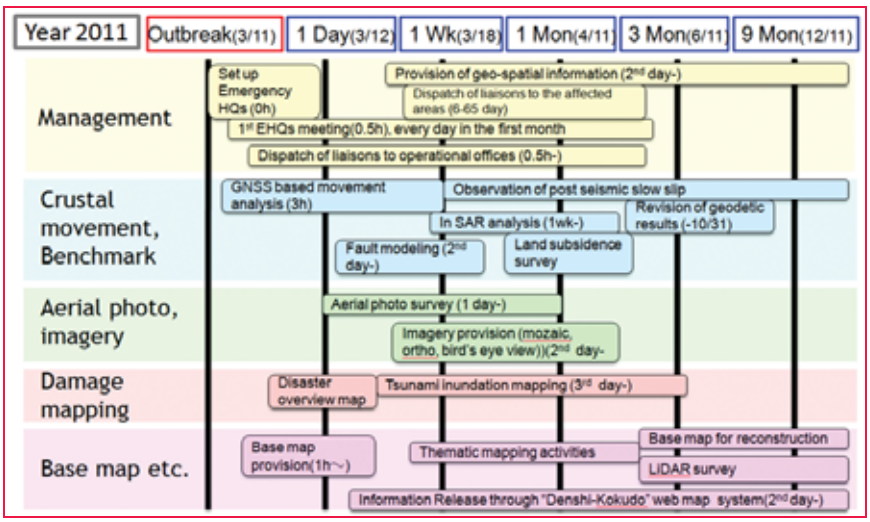

Figure 1: Summary of GSI disaster response activities

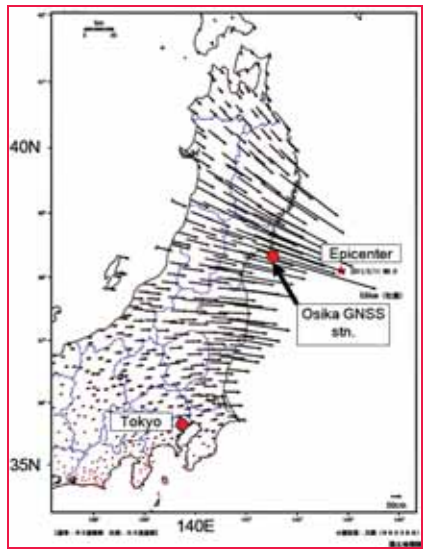

Figure 2: Horizontal displacements by the main shock (GSI, 2011a)


UniStrong
UniStrong Deva
Mobile your GIS
• High-sensitivity GPS module
• Small and compact design for handheld
• Windows Mobile OS
• 3.5'' Sunlight readable QVGA touch screen display
• GSM module for seamless connection with control center
• High capacity battery lasting for whole day work
• Waterproof and dustproof to IP65
• 3M auto focus camera
• Bluetooth supports RFID reader and 1&2D bar code scanner
Distributors Wanted
For more info: www.unistrong.com/english
Tel: +86 21 5172 7616 Fax: +86 21 5445 2060 E-mail: overseas@unistrong.com

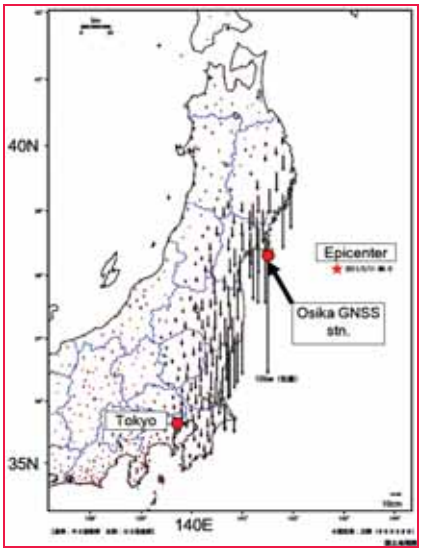

Figure 3: Vertical displacements by the main shock (GSI, 2011a)

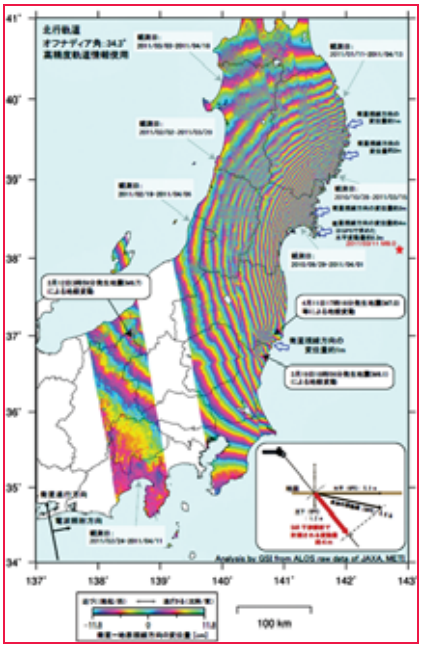

Figure 4: Surface movements distribution detected by In SAR analysis (GSI, 2011c)

for damage reconnaissance in any circumstance. Since GSI's survey aircraft was in statutory inspection, the first thing GSI aerial survey team did was to ensure the availability of survey aircrafts of private companies, in cooperation with an association of aerial survey companies. Six companies responded to the emergency request by GSI on that day. In parallel, GSI also asked relevant organizations for their areas of interest for damage reconnaissance to make aerial survey plan. Due to nice weather, the air crew teams took aerial photos of major damaged

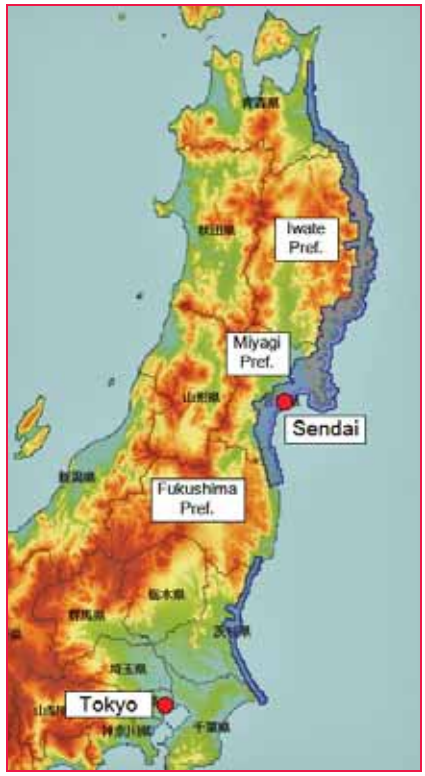

Figure 5: Aerial photo coverage (GSI, 2011d)

Figure 6: An example of orthophoto map, Rikuzen takada city, Iwate prefecture (Imagery ID:10NF671) (GSI, 2011e)

areas on March 12 and 13. The remaining areas were taken in the following survey missions. The final aerial photo coverage is depicted as the blue areas in Figure 5. Quick image processing enabled GSI to deliver the imagery to major government organizations and uploaded it to GSI's website from March 14, 2011, onwards. Some people gratefully reported that they were relieved to make sure that their friends' house was not damaged nor broken by the tsunami only by viewing the photographs on the website. A series of aerial photo data included: single frame photos, orthophotos, orthophotomap (Figure 6) (orthophoto overlain by line map), as well as pairs of orthophotos (before and after the tsunami)

Figure 7: An example of inundation area map, Sendai area, Miyagi prefecture (GSI, 2011f)

and oblique view photo in some areas.

Tsunami inundation mapping

When it became clear that most damages were caused by the massive tsunami that took place the day after the main shock, identification of tsunami inundation areas became of high priority for rescue activities. GSI organized a team for inundation mapping on March12, 2011. The team started photo interpretation to delineate inundation areas as soon as the first aerial photographs became available in the afternoon of March 13. One thousand nine hundred aerial photos were used to make the first version of inundation map which was available to the public on March 14. Several updates were made with additional aerial photographs. Eventually the team found that 561 sq km was inundated by the tsunami. An example of the inundation map is shown in Figure 7. The pink areas are inundated areas in the figure.

Provision of base maps and thematic maps

Responding to the high needs of base maps (topographic maps etc.,) for disaster operation management, GSI also delivered them to requesting organizations mainly in paper form. Several kinds of thematic

maps were also produced. One example is the evacuation zoning map (Figure 8). The government designated evacuation zoning areas around Fukushima Daiichi Nuclear Power Plant on April 22, 2011. Accordingly, GSI produced the map in collaboration with Cabinet Secretariat disaster operation center and made it open to the public.

Provision of geospatial information and its use

GSI's disaster related products were mainly provided through four channels. The first channel was humanitarian relief transportation system operated by JSDF (Japanese Self Defense Force). The second was providing information through GSI liaisons attached to local disaster headquarters. The third was provision through the Geospatial Information Support Team. Under EHQs, this team acted as the one-stop center of provision of products to meet high demands of geospatial information from public organizations. The forth provision was through the website (www.gsi.go.jp) mainly targeting the general public.

Table 1 shows the numbers of cases of provision by the second and the third channels. A total of 1,491 cases were handled (Nakai et al., 2011). Among the organizations that would send their requests, 90% were central and local government organizations. In addition to the cases summarized in Table 1, much more products were browsed and downloaded through the website.

The following list shows a few examples of use of geospatial information by relevant organizations:

- Damage identification, issuance of building damage certification to citizens (local governments);
- Operation of searching for dead bodies (police, Self Defense Force);
- Facility damage identification (Ministry of Land, Infrastructure, Transport and Tourism);
- Consideration of exemption from property tax by local governments in damaged areas (Ministry of Internal Affairs and Communications), and
- Enterprise affection evaluation (corporate analysis consultants).

Figure 8: Evacuation zoning map (GSI, 2011g) (Note: Zoning scheme has been revised accordingly)

Reconstruction support activities

Not only disaster response activities, but GSI also redeveloped geospatial base in support for reconstruction activities in damaged

Table 1: Numbers of cases of GSI products provision (From 11 March 2011 until 25 November 2011) (Nakai et al., 2011)

Product		GSI intiative based	Request based	Total
Geodetic	Geodetic results of reference points	0	7	7
	Crustal movement data	0	6	6
Aerial Photos	Areal Photographs	234	73	307
	Orthophotos	195	81	276
	Bird's eye view photos	0	6	6
	Ortho photo maps	161	59	220
Tsunami inundation	Tsunami inundation map	167	175	342
Basemap	Small scale maps	38	1	39
	1:200,000 scale regional maps	8	0	8
	1:50,000 scale topographic maps	33	8	41
	1:25,000 scale topographic maps	1	11	12
	Print outs of web based basic maps	3	17	20
	Historical topographic maps	0	2	2
	Wide area base map for disaster operation	6	28	34
Thematic maps and Others	Transport recovery progress map	2	0	2
	Base map for recovery and reconstruction	4	12	16
	Digital elevation map	1	7	8
	Concentric circle map around the nuclear power plants	2	15	17
	DEM at 5 m resolution	0	30	30
	Images captured by mobile mapping system (MMS)	0	2	2
	Homepage serve with restricted access	26	2	28
	Order made map	5	20	25
	Others	16	27	43
Total		**902**	**589**	**1,491**

areas. The first activity is the revision of geodetic framework. The large ground surface movements by the earthquake required total revision of coordinates of ground control points in the area. First, the results of GNSS-based control stations were revised by the end of May 2011. In succession resurvey of 1,900 triangulation points and 1,900 bench marks was implemented. The results were eventually integrated into the 'Japanese Geodetic Datum 2011 (JGD2011)' in October 2011. The detailed aspects of this work are precisely reported in Yamagiwa et al. (2012).

Secondly, a series of aerial photographs and 1:2,500 base maps in support of reconstruction planning were developed for the damaged areas of 5,320 sq km. The products have been available since January 2012. Furthermore, LiDAR survey covered 10,876 sq km of coastal areas affected by the tsunami and mountain areas vulnerable to landslides to produce DEM at 5 m (partly 2 m) resolution. Furthermore, coastal LiDAR survey at 5 km swath was conducted in the areas outside the damaged areas, to prepare tsunami hazards in future.

Achievements and challenges

The following achievements were identified as a result of GSI's disaster response activities.

- A chain of quick actions of data gathering and development enabled GSI to release its products from the early period of disaster response. This achievement owes to the experiences accumulated among the staff, regular drilling and necessary provision of equipment in advance.
- Devising new arrangements for efficient data delivery: Geospatial Information Support Team performed well in providing data, interacting with requesters on their needs. Collaborations with other government organs for data delivery to difficult areas also worked. Posting liaison to disaster operation offices was also effective to catch-up with rapidly changing geospatial needs of organizations according to post disaster phase development.
- A wide range of usage of GSI geospatial information products was recognized, quantitatively and qualitatively. In fact, this huge disaster gave GSI an opportunity to demonstrate its capability of damage reconnaissance and supporting reconstruction activities.

Meanwhile, the following challenges were also recognized and urged GSI to further improve its disaster response capabilities.

- Resiliency and redundancy of energy, communication and facilities: Some data from GNSS-based station were lost or unable to send due to the destruction of communication and power failures. Supplementary battery did not allow the stations to work more than 72 hours after power outage. By external failures, GSI headquarters were also struck by power outage and internet disconnection. These problems made GSI reinforce its back up equipment such as auto generator, water storage and other facilities.
- There are still rooms for more efficient information development and rapid provision. After the disaster, GSI reviewed its response activities, found problems and proposed solutions for further improvement. Some of the solutions were tested in disaster response drills thereafter.
- Not all the users were satisfied with GSI's data provision. Particularly, some volunteers in the mapping community which emerged in recent years for disaster response were not satisfied with the technical and policy aspects of GSI's data provision. Their point reflects GSI's emphasis on products provision to rescue and recovery organization (mostly public) and non-professional general public through its website. GSI needs to optimize its performance to satisfy diversified data needs in emergency through establishing public relations with various stakeholders during inter-disaster periods.

Conclusions

GSI conducted response activities at full strength against the tragic East Japan Great Earthquake. GSI's Geospatial information was well utilized by various people and organizations in disaster response activities. Meanwhile, new challenges were recognized through the experience, prompting continuous improvement of disaster response capabilities. As occurrence of natural disasters never ends, national mapping agencies or equivalent geospatial organizations in each country need to make their best efforts to provide stakeholders with necessary geospatial information products in emergency. In this context, we hope our experience would be informative and encouraging for our colleagues in the fields of disaster and emergency response and management.

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ITU-R Recommendations on RNSS systems

The International Telecommunication Union (ITU) Membership considered and approved on 12 January 2012 a package of seven ITU-R Recommendations on radionavigation-satellite service (RNSS) systems as listed below

Recommendation ITU-R M.1787-1 - Description of systems and networks in the radionavigation-satellite service (space-to-Earth and space-to-space) and technical characteristics of transmitting space stations operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz

The information on orbital parameters, navigation signals and technical characteristics of systems and networks in the radionavigation-satellite service (RNSS) (space-to-Earth, space-to-space) operating in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, and 1 559-1 610 MHz are presented in this Recommendation. This information is intended for use in performing analyses of radio frequency interference impact between systems and networks in the RNSS and with other services and systems.

Recommendation ITU-R M.1901 - Guidance on ITU-R Recommendations related to systems and networks in the radionavigation-satellite service operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz

This Recommendation is intended to provide guidance on other ITU-R Recommendations related to the technical characteristics and protection criteria of radionavigation-satellite service (RNSS) receiving earth stations and characteristics of RNSS transmitting space stations planned or operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz. In addition, this Recommendation gives a brief overview of those Recommendations.

Recommendation ITU-R M.1902 - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 215-1 300 MHz

Characteristics and protection criteria for radionavigation-satellite service (RNSS) receiving earth stations operating in the band 1 215-1 300 MHz are presented in this Recommendation. This information is intended for performing analyses of radio-frequency interference impact on RNSS (space-to-Earth) receivers operating in the band 1 215-1 300 MHz from radio sources other than in the RNSS.

Recommendation ITU-R M.1903 - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) and receivers in the aeronautical radionavigation service operating in the band 1 559-1 610 MHz

Characteristics and protection criteria for radionavigation-satellite service (RNSS) receiving earth stations and aeronautical radionavigation service (ARNS) receiving stations operating in the band 1 559-1 610 MHz are presented in this Recommendation. This information is intended for performing analyses of radio-frequency interference impact on RNSS (space-to-Earth) and ARNS receivers operating in the band 1 559-1 610 MHz from radio sources other than in the RNSS.

Recommendation ITU-R M.1904 - Characteristics, performance requirements and protection criteria for receiving stations of the radionavigation-satellite service (space-to-space) operating in the frequency bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz

The characteristics and protection criteria for radionavigation-satellite service (RNSS) spaceborne receivers are presented in this Recommendation. This information is intended for performing analyses of radio-frequency interference impact on RNSS receivers operating space-to-space in the bands 1 164-1 215 MHz, 1 215-1 300 MHz and 1 559-1 610 MHz from emissions of non-RNSS sources.

Recommendation ITU-R M.1905 - Characteristics and protection criteria for receiving earth stations in the radionavigation-satellite service (space-to-Earth) operating in the band 1 164-1 215 MHz

Characteristics and protection criteria for radionavigation-satellite service (RNSS) receiving earth stations operating in the band 1 164-1 215 MHz are presented in this Recommendation. This information is intended for performing analyses of radio-frequency interference impact on RNSS (space-to-Earth) receivers operating in the band 1 164-1 215 MHz from radio sources other than in the RNSS.

Recommendation ITU-R M.1906 - Characteristics and protection criteria of receiving space stations and characteristics of transmitting earth stations in the radionavigation-satellite service (Earth-to-space) operating in the band 5 000-5 010 MHz

Characteristics and protection criteria for radionavigation-satellite service (RNSS) receiving space stations, and characteristics of RNSS transmitting earth stations, planned or operating in the band 5 000-5 010 MHz are presented in this Recommendation. This information

is intended for performing analyses of radio-frequency interference impact on systems and networks in the RNSS (Earth-to-space) operating in this band from radio sources other than in the RNSS.

In addition, a new ITU-R recommendation on characteristics and protection criteria of receiving earth stations and characteristics of transmitting space stations of the radionavigation-satellite service (space-to-Earth) operating in the band 5 010-5 030 MHz has been finalized and is currently under the procedure for approval by consultation which will end in December 2012.

As mentioned above, all these ITU-R recommendations provide characteristics and protection criteria for generic types of RNSS receiving earth and space stations as well as transmission characteristics of all RNSS systems and networks in the bands 1 164-1 215 MHz, 1 215-1 300 MHz, 1 559-1 610 MHz, 5 000-5 010 MHz and 5 010-5 030 MHz, some with safety of life service provisions. All these ITU-R recommendations are freely accessible online at *http://www.itu.int/rec/R-REC-M/en*. The related studies are continuously evolving based on contributions to and participation at the meetings of ITU-R Working Party 4C, the responsible group where all the related work is currently being conducted, so that those ITU-R recommendations can always reflect the most recent developments related to systems and networks in the RNSS.

Resolution 609 (Rev.WRC-07)

Resolution **609 (Rev.WRC-07)** establishes that Consultation Meetings between administrations operating or planning to operate systems in the aeronautical radionavigation service (ARNS) and systems in the radionavigation-satellite service (RNSS) in the 1 164-1 215 MHz frequency band should be held on a regular basis to achieve the level of protection for ARNS systems foreseen in resolves 1 of that Resolution. For more information see Circular Letter *CR/202*.

A web site has been established for participants to the Consultation Meetings, see *Resolution 609 (Rev. WRC-07) Consultation meeting*, for:

- posting of required information from administrations;
- exchange of information;
- posting the results of the epfd calculation from the participants of the RES-609 Consultation meeting;
- posting the results of all RES-609 Consultation meetings.

Outcomes of ITU WRC-12 for the RNSS

WRC-12 Agenda item 1.18

WRC-12 considered under its Agenda item 1.18 extending the existing primary and secondary radiodetermination-satellite service (space-to-Earth) allocations in the band 2 483.5-2 500 MHz in order to make a global primary allocation which would foster the provision of additional services/applications by RNSS systems. The results are as follows:

- Unified primary RDSS allocation in the band 2 483.5 - 2 500 MHz in all regions:
  Region 1: new primary RDSS allocation;
  Region 2: no change to existing primary RDSS allocation;
  Region 3: secondary RDSS allocation upgraded to primary;
- New RDSS power flux-density coordination thresholds to protect in-band terrestrial services (except the radio location service in some Region 1 countries), with more relaxed (1 dB) threshold values in many countries;
- No impact on RDSS systems in operation or filed before WRC-12;
- Consequential upgrade of the radiolocation service to primary status in some Region 1 countries;
- The existing MSS power flux-density coordination thresholds to protect in-band terrestrial services were maintained with more relaxed (1.5 dB) new threshold values in many countries.

It should be noted that there is interest from RDSS operators to provide global services in the band 2 483.5-2 500 MHz with a harmonized regulatory framework. This band is intended to facilitate navigation signals for existing RDSS systems in this band to be used globally and to support potential signals from new RDSS systems, which, because of this band's proximity to mobile service allocations above 2.5 GHz, may offer attractive synergies with terrestrial mobile systems due to improved antenna efficiencies and use of shared hardware not possible with other RNSS bands which could enable innovative low-cost combined navigation/communication applications for the mass market.

WRC-12 Agenda item 1.3

WRC-12 also considered under its Agenda item 1.3 spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS). The result is as follows:

- New allocation of the band 5 030 – 5 091 MHz to the aeronautical mobile (R) service (AM(R)S). Unwanted emissions from the AM(R)S in the frequency band 5 030-5 091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5 010- 5 030 MHz band.

WRC-12 Agenda item 1.4

WRC-12 further considered under its Agenda item 1.4 regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112 - 117.975 MHz, 960 - 1 164 MHz and 5 000 - 5 030 MHz. The results are as follows:

- Additional measures to protect the adjacent RNSS in the band 1 164 -1 215 MHz from the AM(R)S in the band 960 - 1 164 MHz;
- No change in the band 5 000 - 5 030 MHz.

Administrations intending to operate AM(R)S systems in the frequency band 960-1 164 MHz, in order not to cause harmful interference to the RNSS in the band 1 164-1 215 MHz, shall comply with the e.i.r.p. limits for ground and airborne stations set forth in Resolution 417 (Rev.WRC-12).

In summary, the outcomes of ITU WRC-12 were very positive for the RNSS:

- The requested global primary allocation for the RDSS (space-to-Earth) in the band 2 483.5-2 500 MHz was obtained;
- The RNSS was duly protected where there was a risk of harmful interference from new AM(R)S systems.

A war on two fronts for the PND

In the ever-competitive world of technological convergences and advancements, the PND is not evolving at the same pace

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Much has already been written about how the smartphone is sounding the death knell for the personal navigation device (PND), and indeed, traditional PND manufacturers have struggled to cope with this new threat – most are bleeding badly from their PND units. True enough; the highly competitive smartphone market has seen significant development and vibrancy over recent years, as manufacturers claw tooth and nail for market share. In contrast, in the ever-competitive world of technological convergences and advancements, the PND is not evolving at the same pace.

As if coping with the rise of smartphones offering increasingly sophisticated navigation and location-based services was not bad enough, PND manufacturers now face a greater threat to their existence – the in-car navigation system that will soon be a factory-installed part of every automobile sold. The observers who have predicted the extinction of the PND with the advent of increasingly 'smart' smartphones are now sounding the death knell for the PND even louder, and with good reason.

With the smartphone, PNDs can still keep their heads above the water, albeit barely, by the simple, yet key advantages of sheer screen size and functionality in a vehicular setting. This advantage, however, does not hold at all against the in-car navigation system, which indeed promises clearer guidance, better GPS reception, and even the integration of live data on traffic and weather conditions, amongst other propositions which range from voice-controlled music players to restaurant recommendations. Most, in a prescient move, will also have smartphone integration.

Such systems are fast gaining a foothold in the navigation market, and will most likely become mainstream in the very near future. It has been predicted, for example, that Internet-connected vehicles will exceed 90 million in four years, driving a US$14.4 billion market[i].

Essentially, the PND is facing a ferocious market war on two fronts. On these two fronts, it looks like the in-car navigation system will most likely be the more direct threat that finally consigns the PND to the history book of old inventions.

Before we can confidently call winners and losers, however badly the tide may seem to be turning against the venerable PND, it might still be prudent to have a look at the current state of the in-car navigation system, as well as that of the PND and how it might react to this very real war on two fronts for a share of the lucrative navigation market.

In-car navigation system – the final nail in the coffin for the PND?

Most observers have virtually taken it for granted that the in-car system will sooner than later eliminate the PND.

Yet, to be realistic, as of now most manufacturers are struggling to come out with an integrated system that can both withstand the extreme temperature fluctuations and vibrations in a vehicle, as well as provide reliable, accurate navigation with a passable in-built entertainment system. It is not an easy task, when all this has to be user-friendly as well have the mass market appeal automobile manufacturers are looking at.

For now, a quick Google search for 'proprietary in-car navigation systems' has as its top result, 'Why proprietary in-car navigation systems need to die', in a tech review article published in June this year, which has since been re-circulated with some fanfare online[ii]. The review cites that they are 'behind technologically' compared to the smartphone, and are bundled into an expensive package which add cost to the vehicle (a recent analysis puts this at 30-50 times the cost of a conventional PND[iii]). Furthermore, they are not yet well-integrated with other functions and are rendered obsolete quickly compared to the average lifespan of a vehicle, or else painstaking and expensive to update. In other words, there is not yet any clear competitive advantage over traditional PNDs.

It is, however, as the ever-optimistic tech advocates say, just a matter of time. And this is true – for PND manufacturers, the question that will no doubt cause them some sleepless nights is likely to be, how quickly can the car manufacturers catch up?

In the current world of tech, it is probably just a short time. In four years (2016), for instance, it has been predicted that most cars will be 'connected cars' with smartphone integration, opening up 'a whole new market to telematics'[iv].

During this time, however, traditional PND manufacturers will not be sitting still – the two giants, Garmin and TomTom, have effectively taken the battle to their competitors by offering their navigation platforms to automotive manufacturers struggling to master the navigation function in their complex in-car systems. This strategy has met with some success due to the well-honed competitive edge in navigation platforms that PND manufacturers still possess vis-à-vis automobile or smartphone manufacturers.

Jack of all trades, master of none – is integration necessarily a good thing?

Smartphone and automobile manufacturers almost inevitably tout integration as the new tech buzzword, the 'next big thing', but is integration and building increasingly connected and complex systems necessarily a good thing?

A question still worth considering is that, on the point of navigation while driving, does the consumer simply want a simple, reliable device that gets him from Point A to B, effectively and safely? A recent US market study conducted by J.D. Power, which is a good bellwether for consumer sentiment in a developed and technologically-advanced market, indicates that consumers like familiarity,

and prioritise functionality and ease of use[v]. Ironically, in-car systems that try to integrate navigation with audio and other features were singled out for dislike.

While manufacturers have rushed ahead in their enthusiasm to create more and more connected systems, the study finds that the cornerstone of in-car dash systems, namely navigation and routing itself, remains problematic and 'is obviously an issue and will continue to be'. Again, ironically, this fundamental shortcoming was noted to be more serious when manufacturers tried to integrate navigation with entertainment features.

Significantly, the 2011 J.D. Power US Navigation Usage and Satisfaction Study of in-car systems found that the Dodge Charger's factory-installed Garmin navigation system was best in owner satisfaction. It's winning points? It has a large 8.4 inch screen, was familiar-looking and easy to use – essentially it was a Garmin PND installed in-dash in the factory.

In other words, PND-based systems are simple, user-friendly and effective – traditional PND manufacturers in effect make a strong case for inclusion as the bedrock of any reliable in-car navigation system. In a move that foreshadows this possible future trend, Mazda and Fiat's sports car arm Abarth have recently also announced partnerships with TomTom to capitalize on its familiarity with consumers and expertise to provide the in-car navigation platform.

In short, the core propositions of traditional PND manufacturers – namely, reliable and functional navigation and routing are critical areas that form their key competitive advantage, and these need constant development and improvement, especially as the PND platform could potentially form the bedrock of any reliable in-car navigation system, if PND manufacturers play their cards right. Such a move will clearly help PND manufacturers not just survive, but indeed thrive in the navigation industry, and maybe even see off the persistent smartphone threat through a dedicated in-car platform.

Most manufacturers are struggling to come out with an integrated system that can both withstand the extreme temperature fluctuations and vibrations in a vehicle, as well as provide reliable, accurate navigation with a passable in-built entertainment system

Evolution and competitive advantage

Another direction that the PND is taking, other than making a strong proposition for integration into in-car systems, is toward the connected PND – a product area that is experiencing strong growth while traditional PND sales have fallen[vi].

This trend can be seen in both the dominant PND manufacturers, namely Garmin and TomTom, which have invested much in the connected PND. In particular, Garmin's recent Smartphone Link app, linking the PND with the smartphone, thereby removing the need for any additional data subscriptions, presents a compelling vision of the future of the PND.

Perhaps some lessons can also be picked up from the All-in-One (AIO) personal computer (PC), an evolution of the traditional desktop which has seen its market growing strongly (by over 35% per year) even when the desktop faces market extinction from the combined threat of laptops, smartphones, and tablets[vii]. The all-in-one PC essentially strikes a comfortable middle ground between desktops and laptops/tablets.

The connected PND could perhaps take a leaf from this strategy and position itself as a functional and very attractive alternative to both the smartphone (too small, issues with connectivity, difficult to use in-car) and the in-car navigation unit (not portable, less user-friendly and user-oriented, difficult to update and upgrade, too expensive).

The way forward

Going by the direction traditional PND manufacturers are taking, into both integration (into in-car systems) and evolution (into the connected PND) leveraging on their core competitive advantages, it is perhaps too early still to take the demise of the PND as a given – it may yet evolve or integrate into a 'new' product that could still prove to be competitive and relevant, especially given the clear flaws that are holding both the smartphone and the in-car unit back in the navigation market, where, after all, *navigation* and getting right, up-to-date, and easy-to-use directions is key.

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[i] Juniper Research - http://juniperresearch.com/viewpressrelease.php?pr=292

[ii] ZDNet - http://www.zdnet.com/blog/perlow/why-proprietary-in-car-navigation-systems-need-to-die/20650

[iii] MotorTrader.com - http://www.motortrader.com.my/news/demand-for-in-car-navi-systems-to-grow/

[iv] Juniper Research - http://juniperresearch.com/viewpressrelease.php?pr=311

[v] USA Today - http://content.usatoday.com/communities/driveon/post/2011/11/study-motorists-blast-flaws-of-cars-navigation-systems/1#.UFmZcI3iYaw

[vi] HIS iSuppli Market Research - http://www.isuppli.com/Automotive-Infotainment-and-Telematics/MarketWatch/Pages/Garmin-Bets-on-New-Smartphone-App-for-Connected-PND-Market.aspx

[vii] ZDNet - http://www.zdnet.com/blog/computers/the-all-in-one-pc-is-alive-and-well/8099

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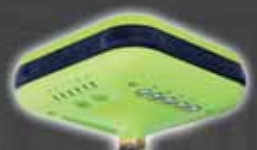

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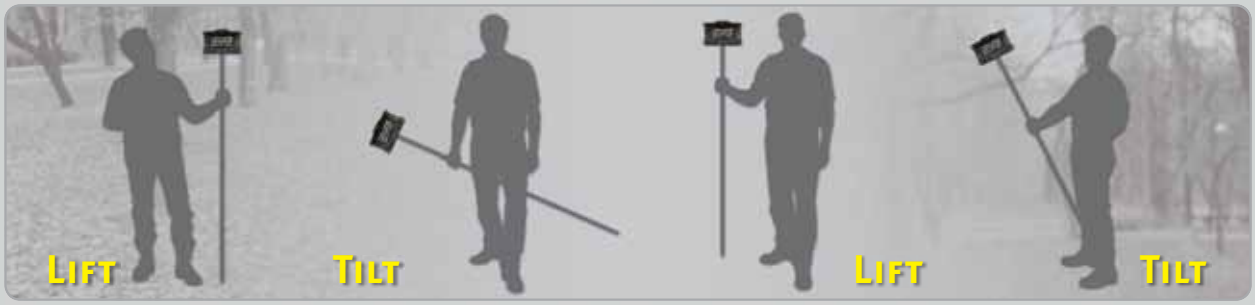

Many sensors, intelligence, and innovations inside TRIUMPH-VS bring this new revolution to surveyors.

You don’t need to look.

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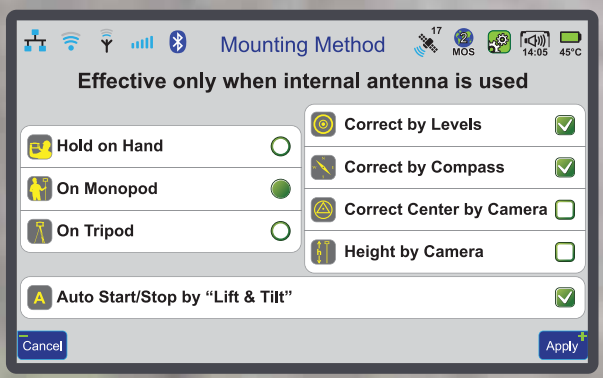
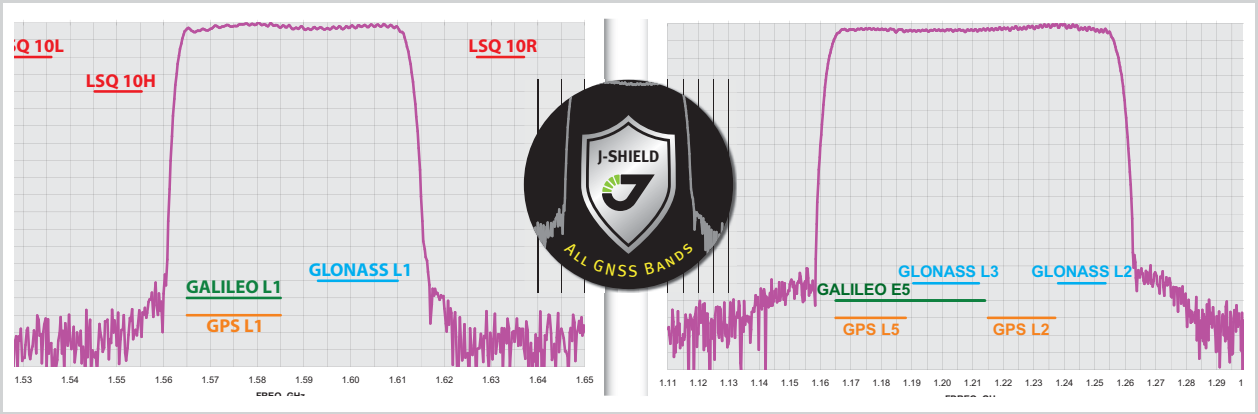


J-shield

Our team has been bringing you the latest GNSS technology for the past 30 years.



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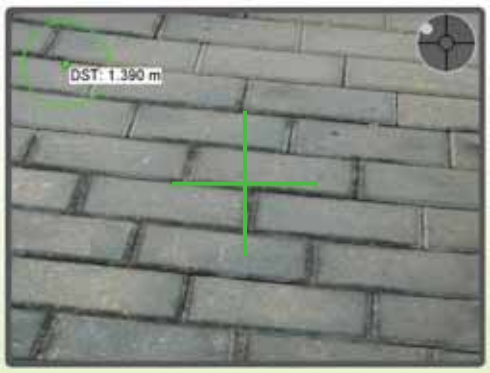
View your target point on the TRIUMPH-VS screen and walk towards it to stake it.



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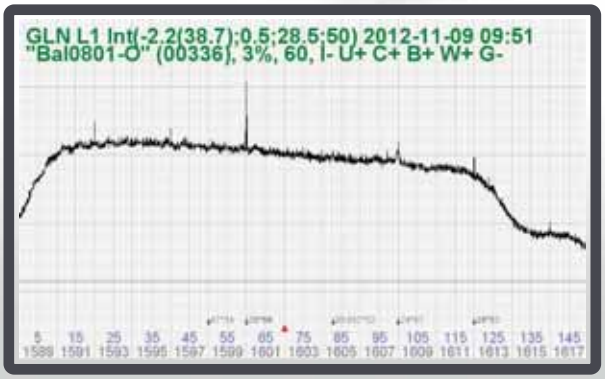
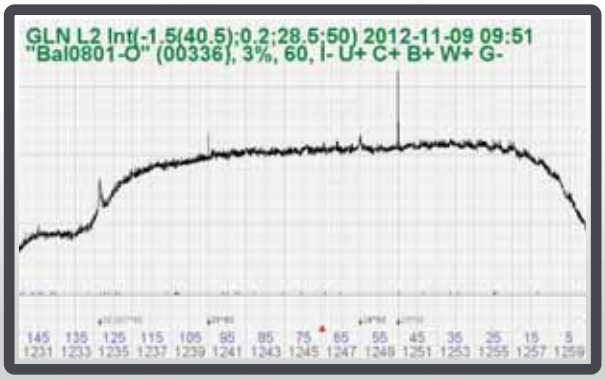
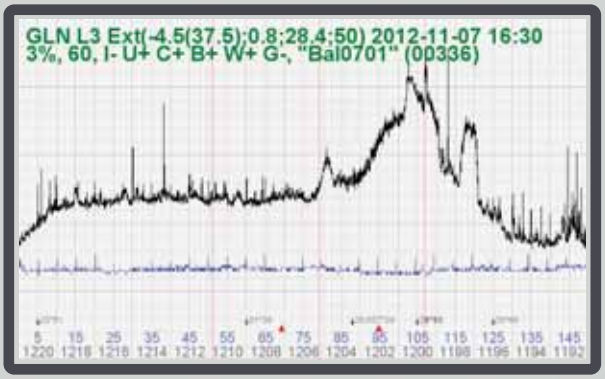
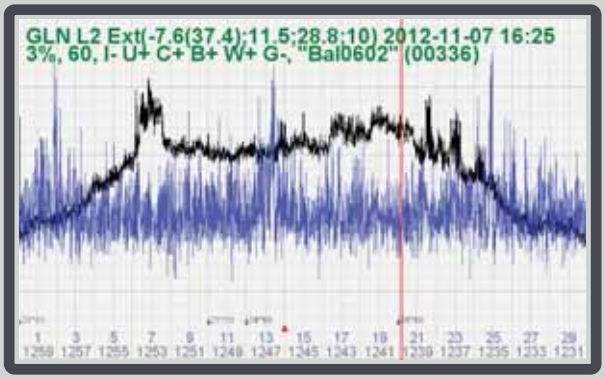




Actual examples of clean GNSS environment





Actual examples of noisy GNSS environments. People could not use these satellites and did not know why.

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Complete software suite for survey, GIS and control.

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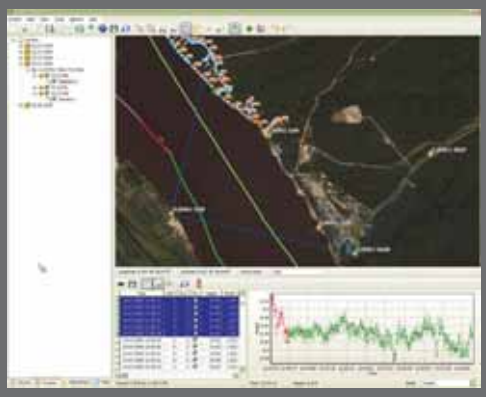

Justin has full range of features for geodetic and surveying tasks.

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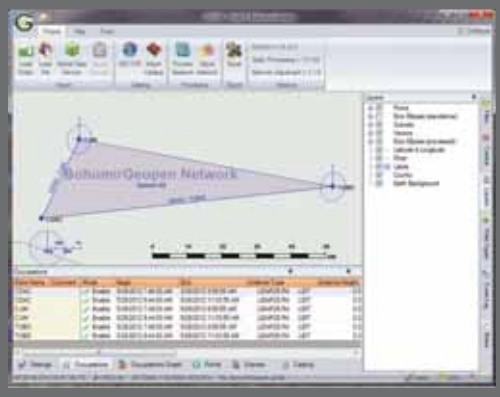

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Data integration and sharing for disaster management

The Philippine Geoportal is an e-government funded project that aims to establish a web portal that provides a system for sharing of and access to geospatial information using one common multiscale basemaps

John SF Fabic
Director
Information Management Department
National Mapping and Resource Information Authority
Department of Environment and Natural Resources, The Philippines

The Philippines is an archipelagic country located in Southeast Asia. It has a total land area of approximately 300,000 sqkm and 36,289 km of coastline. Its neighbors include Taiwan in the North, Indonesia in the South and Vietnam in the West.

The country sits astride the typhoon belt and is visited by an average of 20 tropical cyclones annually. It is situated in a highly seismic area lying along the Pacific Ring of Fire.

The Philippines is considered as a climate 'hotspot' and is widely regarded as one of the world's most disaster-prone countries reflecting both its high incidence of natural hazard events and significant vulnerability. The Germanwatch Global Climate Risk Index (CRI) 2012 Briefing Paper reported that the Philippines is in the top ten most affected countries in the last two decades (1991-2010) both in terms of fatalities and economic losses as a result of the quantified impacts of extreme weather events such as tropical storms, floods and landslides. According to the same report, the Philippines had a total of 270 events in the period covered resulting in an annual average of 800 deaths and $660 million economic losses.

Based on the 2010 census of population and housing, the Philippines has a household population of 92.1 million persons recorded as of May 1, 2010 with 11.8 million coming from the National Capital Region or Metro Manila.

National disaster management initiatives

Because of its geography and geology, the Philippines has a high level of exposure to natural hazards. This being the case, a Philippine government body was created to ensure the protection and welfare of the people during disasters or emergencies. The National Disaster Risk Reduction and Management Council (NDRRMC) developed and led in the implementation of a framework that provides for a comprehensive, multihazard, multisectoral, interagency and community-based approach to disaster risk reduction and management. The National Mapping and Resource Information Authority (NAMRIA),

together with four other government agencies, has been a key partner of NDRRMC in its undertakings in the area of hazard mapping and the conduct of information, education and communication campaigns (IEC) at the community level.

NAMRIA provides the topographic or base maps at scale 1:50,000 and 1:10,000 for the hazard mapping projects of NDRRMC led by the Office of Civil Defense. One of these projects is the 'Hazard Mapping and Assessment for Effective Community-Based Disaster Risk Management' or READY project. The hazard maps produced are flood, rain-induced landslide, earthquake-induced landslide, ground rupture, ground shaking, liquefaction, storm surge, tsunami and volcanic eruption. Through the project's IEC campaigns, these hazard maps are then shared with the sub-national government units or communities for the ultimate purpose of having these maps integrated into their local comprehensive development or land use plans. The READY Project is supported by UNDP and AusAID.

The role of NAMRIA in data sharing for disaster management

NAMRIA, (*namria.gov.ph*), an office attached to the Department of Environment and Natural Resources (DENR, *denr.gov.ph*), is the central mapping agency of the government. It is mandated to provide the public with mapmaking services and to act as the repository of and distribution facility for base maps, nautical charts and other resource data. Its core functions are topographic base mapping, development of the national geodetic network, land classification, hydrographic surveys and nautical charting, delineation of maritime boundaries, and geographic information management.

The READY Project is only one of the collaborative projects undertaken under NDRRMC's Collective Strengthening for Community Awareness to Natural Disasters (CSCAND) Projects. The other undertakings which NAMRIA is a part of are: Building Community Resilience and Strengthening Local Government Capacities for Recovery and Disaster Risk Management (Resilience Project) funded by UNDP and CIDA; Enhancing Risk Analysis Capacities for Flood, Tropical Cyclone, Severe Wind and Earthquake for Greater Metro Manila (Risk Analysis Project) funded by AusAID; and Enhancing Greater Metro Manila's Institutional Capacities for Effective Disaster/Climate Risk Management towards Sustainable Development (READY for GMMA Project) funded by UNDP and AusAID.

Consistent with the shared objectives of the Philippines' NSDI and UN-GGIM, NAMRIA is presently implementing the Philippine Geoportal: One Nation One Map Project which aims at establishing an effective coordination and infrastructure management that would realize the full potential of geospatial information and the underlying technology in order to make geospatial information accessible to and effectively used by a broad range of users. The Philippine Geoportal currently features, among other fundamental datasets, disaster management data showcasing the hazard maps of the READY Project. It will soon host products from the other CSCAND projects.

The philippine geoportal: One nation one map project

In a wider perspective, an effective and robust data sharing system is recognizably vital to any national and local disaster management planning and implementation. At the action scene, the use of Internet-based technology facilitates data sharing even more, especially in the proverbial golden hours. The Philippine Geoportal: One Nation One Map Project (Philippine Geoportal), a technology-based project, captures the essence just described. It is now redefining the landscape of geospatial dissemination in the Philippines.

In 2003, NAMRIA and another government agency, the National Statistical Coordination Board co-led the development of the Philippines' NSDI Framework. In late 2011, the Philippine Geoportal started to concretize the ideas set forth in the PNSDI Framework. It envisions - *"a spatially enabled nation with a comprehensive and consistent geospatial datasets widely available and shared for sustainable economic, environment and social environment and management."*

The Philippine Geoportal is an e-Government funded project that aims at establishing a web portal that provides a system for sharing of and

Conceptual Framework

access to geospatial information using one common multiscale basemaps. The system will provide a mechanism for a clearinghouse network, data management and exchange standards and protocols, and institutional interface that will facilitate the flow of information across all levels of government, the private and non-profit sectors, the academia and other stakeholders, with safeguards to protect misuse and potential risks to individuals, community and country.

The Philippine Geoportal will hold and serve to the general public the basemaps and fundamental datasets that NAMRIA produces and eventually all the thematic datasets of the other stakeholder agencies. It will also promote the participation of local government units having mandate to produce subnational level geospatial data, e.g., land use plans, which is otherwise not being carried out by the national government agencies. The continual build-up of data content, development of GIS-based applications and development of agency/sectoral node portals, will be included in the succeeding phases of the Project.

The Philippine Geoportal also intends to provide an ICT platform for collaboration, data and resource sharing, integration, transparency and resource optimization.

The goals

In the long-run, the Philippine Geoportal should have realized the following outcomes that clearly revolve around sharing of and access to geospatial information.

- One multiscale framework map served and used for government planning, decision making, and monitoring of projects;
- Built-up, updated and maintained databases guided by standards and established data policies;
- Highly accessible and available map and geoprocessing services;
- Implemented policies and procedures on data access, sharing, standards, security and pricing;
- Improved service delivery of maps and data by government map/data producers;
- Citizen-centric portal enabling others to create value-added goods and services;
- Improved capability of government map/data producers to provide data in GIS format; and
- Broader private sector participation in ICT development

The data sharing strategies

In order to relentlessly pursue gathering of commitment of key stakeholder agencies and ensure operational sustainability of the Philippine Geoportal, NAMRIA has prepared three strategic instruments that give emphasis to data contribution and sharing. These are:

- Memorandum of Understanding, which provides for a manifesto of support from the Project Steering Committee whose members are Assistant Secretary and Undersecretary levels and whose agencies were identified as potential sources of fundamental geospatial

data. In terms of data, the instrument aims at allowing NAMRIA to fast track collection of geospatial datasets that can be readily showcased in the Philippine Geoportal. It also intends to gather full appreciation of and commitment from the heads of Departments or agencies through the members at the very onset of the project.

- Data Sharing Agreement, which is an instrument that formalizes the sharing of the geospatial datasets by the all stakeholder agencies who want their data published on the Philippine Geoportal. This document, which is signed between the heads of NAMRIA and stakeholder agency, contains provisions that give assurance regarding security and protection of the datasets contributed by the latter. However, the stakeholder agency is also given the responsibility to take care of the quality of its shared datasets.
- Executive Directive, a policy issuance which can take the form of either an executive order or administrative order. This directive provides for the establishment of the Philippine Geospatial Data Infrastructure and addresses issues on data sharing, access and management in the long-term. It also includes the further development and sustainability of the Philippine Geoportal, the development of the agency node portals, data custodianship and funding. The implementing rules and regulations that would set the detailed guidelines for this policy are still in progress. The policy covers the entire Philippine government bureaucracy.

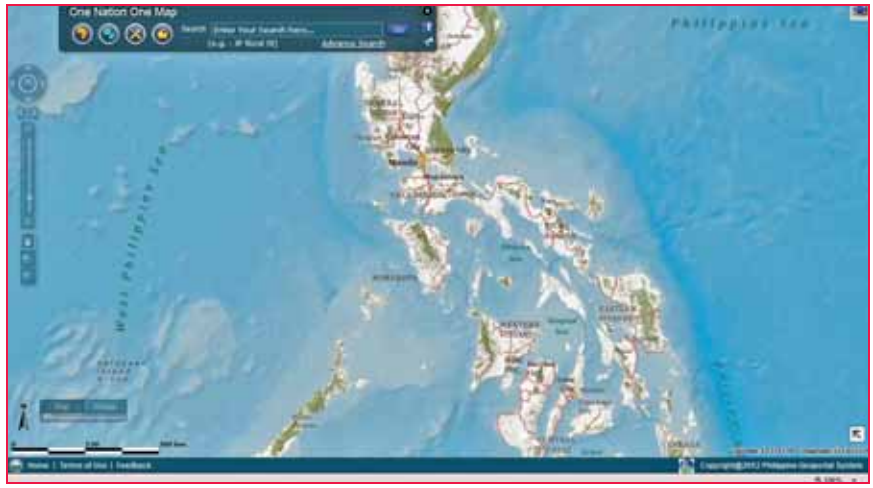
The operational components

The development of the Philippine Geoportal is divided into three phases, the first of which took off towards the latter part of 2011. The plan for the succeeding phases of the project is being prepared in time for the completion of the first phase in the third quarter of the year and for presentation to the approving government authority for funding thereafter.

Seven integral working components will run until the project's completion. These are: applications development, ICT infrastructure establishment, data build-up and integration, training and capability building, policy framework and institutionalization, forward and sustainability planning, and project management.

The status

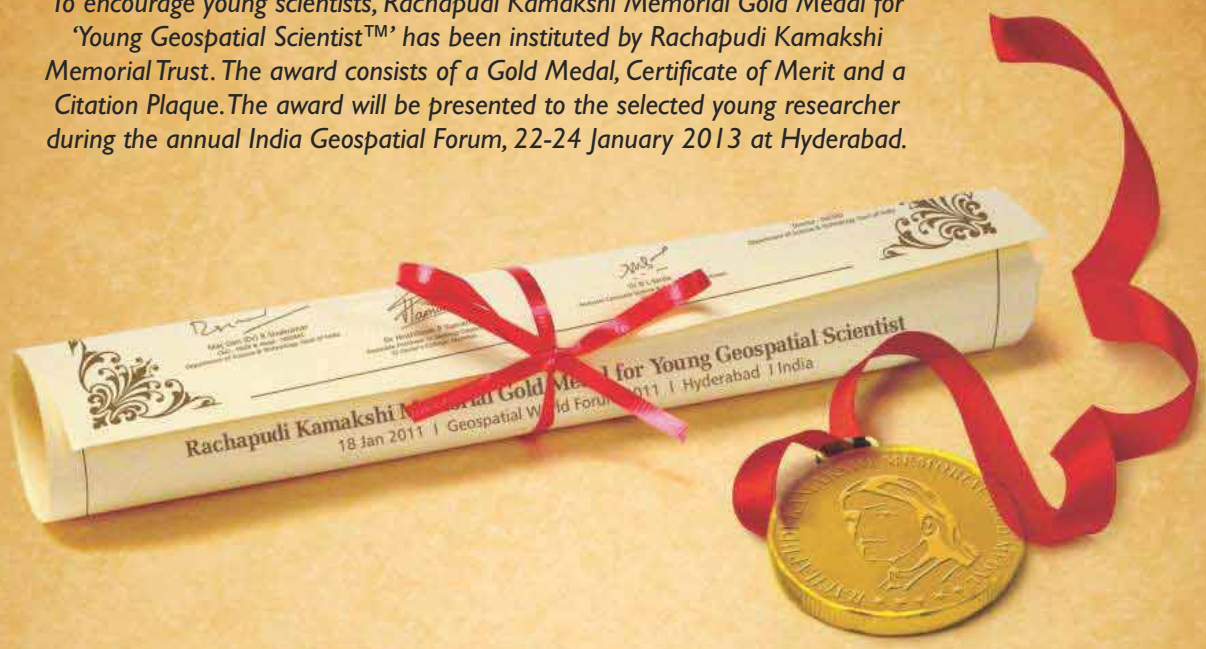
- To date, the Philippine Geoportal is undergoing intensive testing prior to its full commissioning in the last quarter of 2012. NAMRIA and the key stakeholder agencies are participating in the various stages of system trial runs. The Philippine Geoportal covers the following web-based portals: central, system administration, data maintenance, metadata, and system application programming interface.
- The GIS software, hardware and network needed to operationalize the Philippine Geoportal are already in place. Competitive bidding was undertaken for the acquisition of these resources. The enterprise GIS software license was provided by ESRI. The main Philippine Geoportal data center was established by a government service provider, Advanced Science and Technology Institute, to complete the required servers and network installations. A data center was set up in NAMRIA to serve as the hub of the agency and backup of the Philippine Geoportal databases.
- For the data component, NAMRIA has uploaded the available topographic base maps namely, 1:250,000 (whole country), 1:50K and 1:10K (selected areas), LiDAR and orthophotos (Greater Metro Manila, 2011), geodesy (geodetic control points, gravity stations, declination; whole country), hydrography (bathymetry, lighthouses, tide stations), forest cover, and land classification. Key government stakeholder agencies also provided their fundamental datasets to the Philippine Geoportal and these include data on agriculture, environment, health, education, national roads and infrastructure, tourism, transportation and communication, climate and natural hazards.
- To ensure that the Philippine Geoportal will be sustained in terms of the required human resource capacity, key personnel from NAMRIA and stakeholder agencies underwent technical trainings in software, hardware and network. The personnel from stakeholder agencies will be the focals for the development of the agency node portals and databases that will be shared with and published on the Philippine Geoportal. These government agencies will develop and continuously maintain their respective geospatial databases as the primary source of geospatial information for the Philippine Geoportal. They will continue to provide and allocate funds for the acquisition, production and dissemination of their respective mandated geospatial data.
- NAMRIA is in the process of formulating the policy framework and its implementing rules and regulations on the protocols and standards for the sharing and exchange of geospatial data



Screenshot of the Philippine Geoportal system

Rachapudi Kamakshi Memorial Gold Medal for 'Young Geospatial Scientist™ 2012'

To encourage young scientists, Rachapudi Kamakshi Memorial Gold Medal for 'Young Geospatial Scientist™' has been instituted by Rachapudi Kamakshi Memorial Trust. The award consists of a Gold Medal, Certificate of Merit and a Citation Plaque. The award will be presented to the selected young researcher during the annual India Geospatial Forum, 22-24 January 2013 at Hyderabad.



Criteria for selection

Basic criteria for the award will be the research work carried out in the field of geosaptial science and technologies with innovativeness and appropriate use of scientific methodology, backed with quality write-up, social relevance and commercial acceptability of the idea and the adequate usage of geospatial technology.

Selection process

An eminent panel of jury will evaluate the nominations and interact with the nominees, if required, before selecting the awardee.

Past awardees 2010 & 2011

Ms Thiyam Tamphasana Devi, Indian Institute of Technology Guwahati, receiving the 2010 award from Shri Narendra Modi, Chief Minister of Gujarat

Dr M B Rajani receiving the 2011 award from Shri M Shashidhar Reddy, Hon'ble Vice Chairman, National Disaster Management Authority

Nominations

Nominations are invited from scientists, engaged in research work in any of the areas related to Geospatial Information Science and Technology, who is not more than 35 years of age, as reckoned on 31 December 2012.

Nominations for the award should clearly state the scientific contribution supported by relevant documents. Self nominations are permitted.

The nominations are required to be submitted to Dr Hrishikesh P Samant, Assistant Professor & Head, Department of Geology, St. Xavier's College, (Autonomous) Mumbai - 400 001 and also by email at hrishikesh.samant@xaviers.edu or rkmt2011@gmail.com

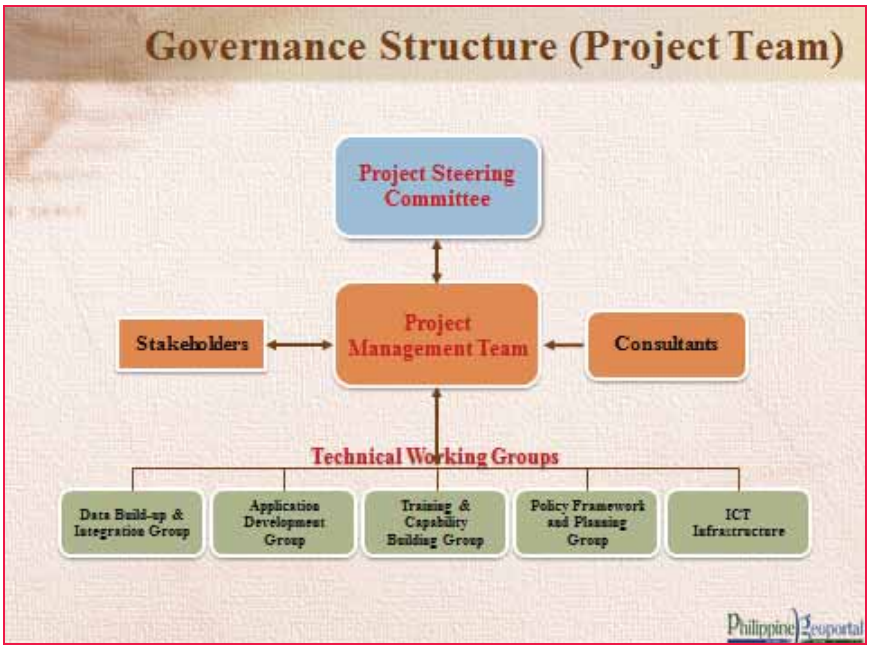
The last date for receipt of the nominations is December 31, 2012

For more information visit: http://www.rachapudikamakshi.org/

in government, with and to the private sector, academe, general public and other stakeholders. This policy also includes data management standards to ensure quality of geospatial data and full compatibility with acceptable standards. A critical element of the policy framework is the inclusion of a provision for funding required for the establishment and initial operation of the Philippine Geoportal through the e-Government funds. For financial sustainability, the policy proposes that the succeeding operational budget be incorporated into the NAMRIA's regular annual budget. Likewise, agencies will include in their annual regular budget the funding for the development and maintenance of their respective agency node portals and for the acquisition, production and dissemination of their geospatial information.

- The overall success of the Philippine Geoportal rests heavily on the online availability and usability of geospatial data; hence NAMRIA will continue to hold extensive information campaigns to ensure participation of data contributors in the broadest possible way. The plan for the succeeding phases of the Philippine Geoportal includes the full implementation of data sharing and access policy, completion of geodatabasing of the 1:50,000 scale topographic maps and nautical charts of NAMRIA, mobile application, crowd sourcing, other map and geospatial processing services, e-payment and data pricing, upgrade in network capacity, mainstreaming of GIS into the government's information strategic plans, expansion of stakeholder agency membership, and operational sustainability.
- At the helm of project implementation is a project management group led by NAMRIA officials who provide the overall direction for and completion of the project activities. The project management group reports to the Project Steering Committee which guides and oversees the project's progress and performance, supervises the technical working groups which implement the various components of the Philippine Geoportal, and coordinates with the consultants, service providers and stakeholder agencies.

Screenshot of Philippine Geoportal showing a hazard map and hospital locations



Project governance structure

The challenges

In the implementation of the project, it had been expected that some issues and concerns could arise especially on data sharing and coordination. This is because of perceived notions about data ownership, privacy and public access, unclear policies on sharing agreements, and liability, among others. These issues have been clarified and addressed in various consultations, roundtable discussions, and high-level meetings with the stakeholder agencies.

The other challenges that the project is facing or will face head on in the immediate future, which the project management group is optimistic in addressing, are:

- Quality of data shared and uploaded to the PGS;
- Low level of GIS development among agencies which may result in underdevelopment of agency/sectoral nodes;
- Low level of appreciation about the Philippine Geoportal among stakeholder agencies;
- Urgency of approval of policies on data acquisition/development,

data sharing, data access, data ownership/custodianship, data security and data pricing; and
- Sustainability (cost recovery, revenue generation) of the Philippine Geoportal.

Alongside the Philippine Geoportal, another technology-based project that is also revolutionizing the way weather-related information is disseminated in the country is Project Nationwide Operational Assessment of Hazards (Project NOAH).

Project NOAH

Project NOAH is the response of the Department of Science and Technology (DOST) to the call of President Benigno S Aquino III for a more accurate, integrated and responsive disaster prevention and mitigation system, especially in high-risk areas throughout the Philippines.

Since its launch in July 2012, the Noah website (*noah.dost.gov.ph*) has been giving the public the unique chance to access data taken from the Philippine weather bureau's weather satellites and Doppler radars that give information on rain-bearing clouds; all-automatic weather stations, rain gauges and stream gauges that track the weather, amount of rainfall and depth of rivers; and manned ground weather stations that validate the data culled from these technologies. All of the automated weather stations, stream gauges and rain gauges are locally developed, and they transmit data to DOST every 10 to 15 minutes, allowing forecasters to see the weather situation in specific areas in near-real time. Data from the instruments and observations are published on the Noah website, which is open to all Internet users.

The project's grand objective is to improve rain and flood forecasting through speedier and more accurate reporting and dissemination of weather information.

By navigating Noah's rainfall prediction indicator, which boasts of a 90 per cent success rate in predicting rainfall in specific areas of the country, Filipinos can tell if rain will fall over certain towns or cities in the next hour, and even in the second, third or fourth hour. Other tools will show water levels in major river systems and these can alert riverine communities to potential flash floods.

Screenshot of NOAH showing the Doppler radar coverage and probability of rain

Screenshot of NOAH showing the flood map of a Metro Manila city

One feature of NOAH is the rainfall contour option where it shows the map of the Philippines with color overlays. The rainfall contour map shows where in the country rained in the past hour. The colors correspond to different amounts of rainfall: light blue for light-to-no rain; blue for moderate rain; dark blue for heavy rain; yellow, intense rain; and red, torrential rain *[newsinfo.inquirer.net]*.

Conclusion

The Philippine Geoportal has started laying the groundwork to improve further the management and dissemination of geospatial information in the country. NAMRIA recommends the following through the Philippine Geoportal:

- Initiate the linking of geospatial information to statistics in the succeeding phases of the project;
- Pursue the building of a business case (geospatial application/map service) on disaster management together with other business cases;
- Ensure that the Philippine Geoportal address issues such as data sharing, policies and arrangements, data quality, promotion and awareness, leveraging on ICT, and private partnership;
- Pursue the development of a knowledge base for geospatial information management; and
- Ensure the long-term operational and economic sustainability of the Philippine Geoportal.

Datum transformations using exclusively geodetic curvilinear coordinates without height information

An alternative method for navigation purposes

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PhD in Geodetic Science
His main interests are: Geodetic Reference Frame realization, Geodynamics, Deformation monitoring and coordinate transformations.

WGS84 is a widely used reference system for navigation purposes, especially using GNSS technologies (Hoffman-Wellenchoff et al. 1997). Furthermore, navigation tools like Google Earth, uses WGS84 coordinates for point acquisition. A main problem is the fact that the major part of national mapping infrastructure (for each country), usually referred to a local (old type) geodetic datum.

National Mapping Agencies (NMA's) in many cases provide 3 translation parameters in order to transform in approximation (e.g with 5-10 meters accuracy) the WGS84 geocentric coordinates to a local datum, using the following formula (pointwise):

$$\begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix}_{LD} = \begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix}_{WGS84} + \begin{bmatrix} dx \\ dy \\ dz \end{bmatrix}_{NMA} \quad (1)$$

where $\begin{bmatrix} x_i & y_i & z_i \end{bmatrix}^T_{LD}$ is the 3-D position vector with respect to the local datum, $\begin{bmatrix} x_i & y_i & z_i \end{bmatrix}^T_{WGS84}$ is the 3-D position vector with respect to the WGS84 and $\begin{bmatrix} dx & dy & dz \end{bmatrix}^T_{NMA}$ is the translation vector provided from the NMAs. In the case of using geodetic coordinates $\begin{bmatrix} \varphi_i & \lambda_i & h_i \end{bmatrix}^T$ (latitude, longitude and geodetic height) of a spheroid, they can be easily transformed to Cartesian coordinates by the implementation of the well-known mathematical formulations (e.g Vanicek and Krakiwsky 1982), pointwise:

$$X_i = (\mathrm{N}_i + h_i)\cos\varphi_i \cos\lambda_i \quad (2a)$$

$$Y_i = (\mathrm{N}_i + h_i)\cos\varphi_i \sin\lambda_i \quad (2b)$$

$$Z_i = [(1-e^2)\,\mathrm{N}_i + h_i]\sin\varphi_i \quad (2c)$$

where $\mathrm{N}_i = a / \sqrt{1-e^2 \sin\varphi_i^2}$ is point's radius of prime vertical, a, e^2 are the major semi-axis and the squared eccentricity of a particular spheroid respectively

The method

Nevertheless, when the geodetic coordinates are introduced, the height information could be either neglected (e.g for vehicle navigation), or even the introduced height information is derived from different source. E.g Google Earth height information uses global DEM models, which are not consistent with the geodetic heights.

An efficient way to overcome this problem is to express the Cartesian system translations to curvilinear coordinate differences respectively. This could be done using the relation between them, given by (e.g Okkeke 1998, Ampatzidis 2006, Kotsakis 2007):

$$\begin{bmatrix} d\lambda \\ d\varphi \\ dh \end{bmatrix}_{NMA} = \mathbf{Q} \begin{bmatrix} dx \\ dy \\ dz \end{bmatrix}_{NMA} \quad (3)$$

where

$$\mathbf{Q} = \begin{bmatrix} -\dfrac{\sin\lambda_i}{(\mathrm{N}_i + h_i)\cos\phi} & \dfrac{\cos\lambda_i}{(\mathrm{N}_i + h_i)\cos\phi_i} & 0 \\ -\dfrac{\sin\phi_i \cos\lambda_i}{M_i + h_i} & -\dfrac{\sin\phi_i \sin\lambda_i}{M_i + h_i} & \dfrac{\cos\phi_i}{M_i + h_i} \\ \cos\phi_i \sin\lambda_i & \cos\phi_i \cos\lambda_i & \sin\phi_i \end{bmatrix} \quad (4)$$

$M_i = a(1-e^2) / \left(\sqrt{1-e^2 \sin\varphi_i^2}\right)^3$ is

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point's radius of the meridian curvature. Because $N_i \gg h_i$ and $M_i \gg h_i$ and taking account that $a \approx N \approx M$, Q could be re-written (with out loss of severe accuracy for navigation applications):

$$\mathbf{Q} \approx \begin{bmatrix} -\frac{\sin\lambda_i}{a^{WGS84}\cos\phi} & \frac{\cos\lambda_i}{a^{WGS84}\cos\phi_i} & 0 \\ -\frac{\sin\phi_i\cos\lambda_i}{a^{WGS84}} & -\frac{\sin\phi_i\sin\lambda_i}{a^{WGS84}} & \frac{\cos\phi_i}{a^{WGS84}} \\ \cos\phi_i\sin\lambda_i & \cos\phi_i\cos\lambda_i & \sin\phi_i \end{bmatrix} \quad (5)$$

Hence, we can express now the curvilinear differences between the WGS84 and the local datum, as follows (angular units must be in radians):

$$\lambda_i^{LD} \simeq \lambda_i^{WGS84} + \frac{-\sin\lambda_i^{WGS84}dx_{NMA} + \cos\lambda_i^{WGS84}dy_{NMA}}{a^{WGS84}\cos\varphi_i^{WGS84}} \quad (6a)$$

$$\varphi_i^{LD} \simeq \varphi_i^{WGS84} + \frac{\sin\varphi_i^{WGS84}\left(-\cos\lambda_i^{WGS84}dx_{NMA} - \sin\lambda_i^{WGS84}dy_{NMA}\right) + \cos\varphi_i^{WGS84}dz_{NMA}}{a^{WGS84}} \quad (6b)$$

For example, in the case of Greek Geodetic Reference System 1987 also known as GGRS87, the translations are (HCCO 1987):

$$\begin{bmatrix} dx \\ dy \\ dz \end{bmatrix}_{HCCO} = \begin{bmatrix} 199.87 \\ -74.79 \\ -246.62 \end{bmatrix} m \quad (7)$$

Taking account (5), the transformation between WGS84 and GGRS87 is:

$$\lambda_i^{GGRS87} \simeq \lambda_i^{WGS84} + \frac{-199.87\sin\lambda_i^{WGS84} - 74.79\cos\lambda_i^{WGS84}}{a^{WGS84}\cos\varphi_i^{WGS84}} \quad (8a)$$

$$\varphi_i^{GGRS87} \simeq \varphi_i^{WGS84} + \frac{\sin\varphi_i^{WGS84}\left(-199.87\cos\lambda_i^{WGS84} + 74.79\sin\lambda_i^{WGS84}\right) - 246.62\cos\varphi_i^{WGS84}}{a^{WGS84}} \quad (8b)$$

It can be implied that in the curvilinear coordinate transformation is a function of Cartesian system translations, initial reference frame latitude, longitude and spheroid's associated quantities (major semi-axis and eccentricity). The whole procedure is more complicated than the case of Cartesian coordinates, reflecting the fact that the transformation referred now to a non-Euclidean surface (spheroid).

The transformation of local datum to WGS84 curvilinear coordinates

In the case of the need of transformation from the local datum to WGS84 curvilinear coordinates, the method could also stand for this purpose. The only modification is the introduction of the translation parameters with different sign. Eq. (6) takes now the following form:

$$\lambda_i^{WGS84} \simeq \lambda_i^{LD} + \frac{\sin\lambda_i^{LD}dx_{NMA} - \cos\lambda_i^{LD}dy_{NMA}}{a^{LD}\cos\varphi_i^{LD}} \quad (9a)$$

$$\varphi_i^{WGS84} \simeq \varphi_i^{LD} + \frac{\sin\varphi_i^{LD}\left(\cos\lambda_i^{LD}dx_{NMA} + \sin\lambda_i^{LD}dy_{NMA}\right) - \cos\varphi_i^{LD}dz_{NMA}}{a^{LD}} \quad (9b)$$

Eq. (9) gives the advantage of the direct transformation between the local datum and the WGS84 without introducing any geodetic height information, which is quite problematic in old type of datums. The major semi axis refers to the local datum spheroid. Hence, from any map (old or new) the transformation could be implemented with a straightforward procedure.

Conclusions

In the present paper is presented a method of transforming curvilinear coordinates from WGS84 to local datum and vice versa. The basic idea of the method lies on the connection between the translations of a Cartesian system and curvilinear differences on a particular spheroid. The strategy could be useful in the cases of either neglecting or having inconsistencies on height information for one (or both) geodetic system(s).

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- An alternative method for the transformation of the curvilinear coordinated from/ to WGS84 for navigation purposes.
- The main idea is to express the Cartesian translations between two reference systems as curvilinear coordinate differences.
- The method could be used in numerous mapping or/and navigation applications for fast and reliable transformations.
- This is a "height-free" method, in terms of not introducing height information.
- Could be implemented all over the world.

Integrative function in the geo growth market confirmed

Around 16,000 trade visitors gather at INTERGEO 2012 in Hanover

The essence of INTERGEO can be summed up in the following statement: "We need to turn data into intelligent information and then transform this into knowledge and actions." The world's most important conference trade fair for geodesy, geoinformation and land management draws to a close today after three amazing days in Hanover. The annual industry gathering featured an exhibition area of 28,000 square metres and more than 140 presentations focused on the processing, application and economic value of geodata.

"It was CheeHai Teo, President of the FIG – the International Federation of Surveyors – who summed up what our industry is all about with this statement," says Professor Karl-Friedrich Thöne, President of INTERGEO patron the DVW (Society for Geodesy, Geoinformation and Land Management). Geoinformation really does play an important, indeed a prominent, role in issues ranging from the energy revolution to demographic change.

In Hanover, 16,000 trade visitors once again obtained information about industry innovations and trends from 520 companies, institutions and associations located in 31 different countries. And close to 1,400 conference participants were involved in intensive interdisciplinary dialogue in 40 subject areas at the Hanover Convention Centre. The inclusion of the first National INSPIRE Conference, the CLGE (Council of European Geodetic Surveyors) conference and the Navigation Conference in the INTERGEO programme underlined the industry platform's growing integrative significance. "The networks within the geo community and with political, business and local authority partners are becoming more closely knit all the time. Cooperation between key GIS associations and the newly formed INTERGEO Advisory Board with ESRI, Hexagon and Trimble as partners are clear signs of this development," says Thöne.

At the European Students Meeting (ESM) alone, just under 300 students got the chance to discover innovations and trends during the second day of INTERGEO, at the DVW's invitation. "Even with the excellent conditions the industry offers, more attention needs to be paid to attracting talented young individuals to the profession," stresses Thöne.

Transforming images into data – a photogrammetric evaluation station at INTERGEO 2012 in Hanover.

The participating companies, institutions and associations encountered well-prepared trade visitors and enthusiastic potential new recruits. In an initial survey, exhibitors were united in their praise for the high quality of contacts they made. No fewer than 90 percent of exhibitors indicated that they had achieved their trade fair targets, and 92 percent said they intended to exhibit at INTERGEO 2013 in Essen.

In her keynote speech on the first day of INTERGEO, Cornelia Rogall-Grothe, State Secretary at the German Federal Ministry of the Interior and the government's representative for information technology, highlighted the industry's potential in figures – an annual market volume of 40 billion euros and 30,000 new jobs within the next five years.

"The market for geoinformation is one of the world's most vibrant growth markets and INTERGEO will continue to extend its role as a meeting place for the industry," says Olaf Freier, CEO of Hinte GmbH in Karlsruhe, which organises the event. *www.intergeo.de*

Visitor, exhibitor and exhibition area statistics for this event are calculated and certified in line with the standardised definitions of the FKM (Society for the Voluntary Control of FaiWr and Exhibition Statistics).

*- **Denise Wenzel**, HINTE GmbH*

Beidou commercial services can generate high revenues

The municipality of Beijing is encouraging investment in the navigation and location-based services industry, suggesting there is a market worth at least 50 billion yuan ($8 billion) by 2015 after China put its own satellite navigation network into commercial use.

The reaction comes after the latest satellite in China's Beidou-2 navigation system was launched in Xichang in October. The system is expected to start providing positioning and navigation services for China and neighbouring areas by the end of this year and provide global coverage by 2020. *http://usa.chinadaily.com.cn/business/2012-11/21/content_15949299.htm*

GLONASS hit by firing of top spacecraft designer

The chief designer or Russia's scandal-hit GLONASS satellite navigation system, Yury Urlichich, has been sacked from his services. The decision was made by the government's military-industrial commission, which is headed Deputy Prime Minister Dmitry Rogozin. Russia's rival to GPS was rocked by fraud allegations earlier this month, with the Interior Ministry accusing unnamed GLONASS officers of embezzling 6.5 billion rubles (USD 200 million) of programme's funds.

Russia's new GNSS mandate to require Glonass receivers

Russia plans to soon announce that its civil aviation fleet will be required to carry Glonass, that nation's GNSS, or combined Glonass/GPS units, but not GPS on its own. Foreign-registered aircraft flying in Russian airspace would be exempt from the rule.

The prohibitive cost stems from the different technology in Glonass and GPS receivers. Glonass uses the so-called frequency division signal technology, while GPS uses code division methods and the two simply don't understand each other. Inserting some sort of translator device sounds like a simple solution and is, loosely speaking, used in some special types of land survey satnav receivers. But aviation calls for demanding certification, and therein lies the rub, since no such equipment is available on the aviation market, and no western avionics manufacturer has shown interest in developing combined units for that niche market. In addition, such a unit would require modifications to the flight management and other onboard systems, including the need for two separate antennas.

It seems unlikely that Russia will modify its upcoming mandate proposal, since it has made massive investments in Glonass–which, like GPS, is a global system–to compete in the world GNSS market, of which aviation is a minuscule part, compared to vehicles. Millions of people worldwide own Chevrolets, Fiats, Toyotas and other brands and can

make just about any changes they wish, but for an aircraft owner, certification of new avionics units and their retrofit substitution for earlier or different units is a morass of cost and downtime. And with a Russian precedent, China could eventually consider the same approach with its global Compass GNSS. *www.ainonline.com*

GPS to monitor housing schemes, misuse of funds in Indian state

The government has ordered to implement GPS technology in an effort to put a stop to the irregularities happening under Housing schemes. Earlier nodal officers of Rajeev Gandhi Rural Housing Coporation made a visit to the villages where the houses of the beneficiaries are under construction and verify the details and were using the GPS technology only for monitoring the sites. If the documents are approved the funds were remitted to the respective beneficiaries' accounts. But with the rise in allegations that the officials were hand in glove with the beneficiaries and were sanctioning funds even when the construction of the house is in basement level, the government had directed to use GPS to monitor the scheme and then approve further funds. *http://www.deccanherald.com/content/288977/gps-monitor-housing-schemes-misuse.html*

Lockheed Martin completes critical environmental test on GPS III pathfinder

The Lockheed Martin team developing the U.S. Air Force's next generation Global Positioning System III satellites has completed thermal vacuum testing for the Navigation Payload Element (NPE) of the GPS III Non-Flight Satellite Testbed (GNST). The milestone is one of several environmental tests verifying the navigation payload's quality of workmanship and increased performance compared to the current generation of satellites. *www.spacedaily.com*

World's smallest multi-GNSS module

UC530M by u-blox is the world's smallest parallel GPS/GLONASS module with built-in antenna. The antenna module is easily embeddable in space-restricted environments thanks to its tiny footprint of only 9.6 x 14.0 x 1.95 mm. The highly integrated SMT design reduces the need for external components and minimizes manufacturing costs.

NIS Glonass to partner BSNL, MTNL in India

The governmment of India will shortly clear a three-way partnership between Russia's NIS Glonass, BSNL andMTNL for delivering satellite-based navigation services in India.

The development comes on the heels of Russia's plans to roll out satellite-based information services akin to 'GPS' on the Glonass system in international markets like India. *http://articles.economictimes.indiatimes.com*

Nikon NivoTM 5M total station chosen for aircraft leveling

One of the world's most successful military training aircraft, the PZL-130 TC Orlik, manufactured by EADS PZL "Warszawa-Okecie" S.A., is now being leveled with the aid of a Nikon Nivo 5M total station. Aircraft leveling, both longitudinal (forward and aft) and lateral (left to right), is performed in the final stages of assembly. Accurate leveling of the aircraft on the ground is required before precise alignment and symmetry checks can be performed to confirm that the geometry of the aircraft is to specification.

Prior to using the Nikon Nivo total station, leveling was accomplished with a theodolite and precision leveling rod. The theodolite system was very easy to use, but distances could not be measured, and it required manually calculating the height differences and calculation errors and manually entering the values into a computer.

Leica Viva GS14 Compact GNSS Receiver

Leica Geosystems expands its Viva portfolio with the Leica Viva GS14 GNSS receiver. It has a compact light-weight design with integrated communication devices and is flexible to be deployed in any situation. Together with the most reliable GNSS RTK, the Leica Viva GS14 delivers complete confidence and knowledge in results. This combination makes the Leica Viva GS14 one of the most convenient high-performance GNSS receiver. *www.leica-geosystems.com*

Trimble and Bentley Create Strategic Alliance

Bentley Systems and Trimble have announced a strategic alliance to further the connection between the virtual and physical environments for infrastructure projects. This alliance will establish a new benchmark for construction and operations quality, efficiency, and safety. *www.bentley.com*

NovAtel New SPAN® MEMS Enclosed Receiver, Pinwheel OEM GNSS antenna

NovAtel has recently released SPAN® MEMS Enclosed Receiver, Pinwheel OEM GNSS antenna. Mr Jason Hamilton, Director of Marketing at NovAtel shares his views on the same

Which receivers can support NovAtel SPAN® technology?

Our OEM615, OEM628, FlexPak6, SPAN-MPPC and SPAN-SE GNSS receivers all support SPAN.

What are the functions of NovAtel's IMU enclosure, slated as the lightest and smallest?

The SPAN MEMS Enclosed Receiver targets unmanned airborne and land base vehicle system integration markets. Its light weight and small foot print make it ideal for applications such as these that have size and weight restrictions. As with all other SPAN products, the SPAN MEMS Enclosed Receiver can provide exceptional position, velocity and attitude determination under challenging GNSS conditions.

What are the optional add-ons that can be added to the FlexPak6 that houses the new OEM6 Receiver Board?

There is an optional HD15 pin breakout cable that customer can purchase to add-on to the FlexPak6 receiver. Via this cable customers can have easy access to Ethernet, CAN Bus and the traditional I/O signals (PPS, Event markers, VARF, PV, Error and Position Valid pins).

What supporting and alternate products are required by the IMU enclosure?

The SPAN MEMS Enclosure Receiver is a combined GNSS + IMU product and requires a GNSS antenna only. It belongs to the same family as our popular single-enclosure SPAN-CPT system. If customers are looking for OEM solutions, they can purchase standalone receiver boards and the OEM version of our MEMS IMU. The MEMS enclosure can also be paired with an external receiver such as the FlexPak6 to take advantage of our NovAtel ALIGN feature while having continuous position, velocity and attitude information from our SPAN MEMS Enclosure.

How easy is the FlexPak6 to integrate?

The translucent design of the FlexPak6 allows users to view internal status LEDs for easy diagnosis, while a wide input voltage range and an array of interface options including Ethernet, Serial, USB and CAN Bus permit quick and simple integration. The lightweight form factor makes it ideal for weight and power sensitive applications.

What are the core functions of the new Pinwheel® OEM GNSS antenna?

The Pinwheel OEM is a GNSS antenna module that receives L1 + L2 GLONASS, E1 Galileo and L-band correction service signals. Our Pinwheel technology is recognized for its superior multipath rejection and highly stable phase center. The Pinwheel OEM makes this technology available in a component modular form, providing choke ring like performance without the cumbersome size and weight. The Pinwheel OEM GNSS antenna module enables quick integration into OEM manufacturers' own custom designed or branded products.

Introducing our new easier-to-hide OEM6.

The new OEM615 GNSS receiver from NovAtel provides the industry's leading GPS+GLONASS dual frequency RTK positioning performance – in our smallest form factor – so you get all of NovAtel's reliability but in a more discreet, easy-to-integrate card. For more info, visit novatel.com/oem6 or call you-know-who. **Integrate success into your [redacted].**

NovAtel

Trimble Dimensions 2012: Transform the way the world works

Trimble 6th international users conference was held on 5 – 7 November in Las Vegas, USA. It was attended by more than 3,500 registered attendees from 80 countries around the world. The Trimble Dimensions 2012 conference theme—Transform the Way the World Works—provided insight into how information technologies can redefine the way professionals work to achieve success. The conference explored the use of technology in a wide range of applications including heavy civil construction, building construction, survey, cadastral, geospatial, infrastructure, mapping and GIS, transportation and logistics, field service management, energy, utilities, natural resources and government.

Attendees had the opportunity to network with key industry leaders, build partnerships, develop new contacts, discuss opportunities and discover how to overcome obstacles in today?s competitive business environment. With more than 480 sessions, the conference focused on increasing productivity in the field and the office by revolutionizing work processes.

The conference included an off-site demonstration and training area plus a Partner Pavilion that showcased the complete suite of Trimble construction, survey, engineering, aerial and mobile mapping, railway, transportation and logistics, field service, mapping, GIS, utilities, mobile computing, agriculture, forestry and infrastructure solutions. Highlighted solutions and technologies included GNSS; total stations; field computing and data collection; 3D scanning; pre-design construction planning; machine control: 3D visualization; Building Information Modeling (BIM); construction project management; aerial and mobile mapping; wireless communications; data transfer; field and office software; and smart grid applications. In addition, technology providers who are Trimble partners participated to extend the conferences range of products and applications. The conference also included sessions that qualify for Professional Development Hour (PDH) credits. *http://www.trimble.com*

Integrate GPS Signals with your Motion Testing and Simulation

The Real-Time Scenario Generation (RSG™) option for Spectracom GPS/GNS simulators supports high-end motion simulation systems. It allows the input of real time trajectory data from external devices or software via commands which support setting position, velocity, acceleration, orientation, or heading independently. This allows for external control of all or some of these parameters depending on simulation needs or capabilities.

Emapsite int div wins Malawi schools mapping contract

The international consultancy arm of a top UK mapping services provider has won a major government contract in Malawi. Emapsite's international division will deliver a nationwide data capture and GIS project to help with the planning of schools across the African democracy's 34 education districts. It involves the linking of GIS resources with education data such as catchment areas, enrolments, learner-teacher ratios and classroom sizes. *www.emapsite.com/saudi/en.*

QPS Bundles Esri Technology for Bathymetric, Charting, and Survey Solution

Quality Positioning Services (QPS) has signed an OEM agreement with Esri. The agreement enables QPS to bundle its QINSy and Fledermaus products with Esri software and provide a complete hydrographic survey, data management, and charting solution.

Using LabSat in the absence of GPS

In urban environments satellite visibility can be disrupted. Entering tunnels, or accessing inner-city 'canyons', can lead to a clear view of the sky being lost, with navigation devices subsequently providing inaccurate or distorted readings. To tackle this, LabSat have developed a multi-GNSS record and replay system capable of logging and applying digital data. By using signals taken from an inertial measurement device and wheel speed sensors, LabSat is able to replicate vehicle movement using an integrated turntable. *www.labsat.co.uk*

Intergraph® leverages Leica Geosystems' TruView

Intergraph® has introduced a Leica TruView Integrator for SmartPlant® Enterprise as well as offline mobile device support for SmartPlant® Enterprise for Owner Operators (SPO). It enables end-users to use photorealistic and intelligent TruView laser scans as an intuitive portal to access all plant information and documentation in SmartPlant Foundation. inspection and equipment isolation in online and offline mode. *http://www.hexagon.com/en/spo-truview.htm.*

UltraMap v3.0 by Microsoft

The Microsoft UltraCam business unit announces the release of UltraMap v3.0, the first fully integrated end-to-end photogrammetric workflow system for UltraCam images.

GeoEye and JSI Support Japanese Government with EyeQ

GeoEye, Inc. has partnered with the Japan Space Imaging Corporation (JSI), a Mitsubishi Corporation subsidiary, to provide a major Japanese ministry with access to comprehensive high-resolution satellite imagery of all of Japan through GeoEye's EyeQ™ platform. Under the agreement, JSI will use EyeQ to provide Japanese ministry analysts with on-line, on-demand access to the GeoEye- and JSI-owned satellite imagery covering Japan. JSI will manage the flow of online product to the ministry to ensure that ministry analysts receive imagery on-demand and they are able to view the data through Open Geospatial Consortium (OGC) services as part of their work flow process. *www.geoeye.com*

SIRIUS UAV by Position Partners

Position Partners has announced a new Unmanned Aerial Vehicle (UAV) for the Australasian civil construction, survey, mining and agricultural industries – SIRIUS UAV by MAVinci. Designed for a wide range of survey applications, the SIRIUS UAV is a fixed wing structure ideal for corridor mapping roads, pipelines and power lines, calculating stockpile volumes, monitoring erosion, reconciliation and progress reporting. *www.mavinci.de*

Astrium's GRAIN service shows US corn yields are lower than expected

Astrium estimates 2012 U.S. corn yield at 116.0 bushels per acre which is at the lower end of current industry expectations. This forecast is based on Astrium Services' GRAIN (Global Risk Agricultural Intelligence), a unique technology combining satellite imagery processing, agronomic and meteorological models developed over several years. Astrium Services is developing the next generation tools for decision making in the agricultural industry to provide accurate and reliable crop analysis capabilities consistent worldwide at both local and regional levels. *www.eads.com*

US to beef up space surveillance in Australia

The Defense Department has agreed to install surveillance radar in Australia capable of identifying objects in low-Earth orbit and an advanced space telescope capable of eyeballing objects 22,000 miles in space. The agreement follows high-level talks between the two countries.

The joint communique agreed to by Defense Secretary Leon Panetta, Secretary of State Hillary Clinton, Australian Foreign Minister Bob Carr and Defense Minister Stephen Smith also looked at developing a combined communications gateway in Western Australia that the Pentagon's Wideband Global Satellite System could access. Australia invested $740.9 million in the Wideband Global Satellite System in 2007, which eventually will consist of nine satellites in a geosynchronous orbit. Each satellite has a maximum data rate of 3.6 gigabits per second of data.

The C-band ground surveillance radar the Pentagon plans to move to Australia currently is located in Antigua and operates as part of a global space surveillance network to detect, track and identify objects in space. Moving the radar to Australia will provide, for the first time, coverage of space objects in the Southern and Eastern hemispheres and track space launches in Asia, the Pentagon said. *www.nextgov.com*

Nigeriasat-2 wins Sir Arthur Clarke Award

NigeriaSat-2, Earth observation satellite built by SSTL, has won the 2012 Sir Arthur Clarke award for "Best Space Activity - Industry / project". The prestigious awards, held by the British

Galileo update

Galileo Security Monitoring Center being built in France

At the site of the future main Galileo Security Monitoring Center (GSMC) in Saint Germain en Laye outside Paris, a ground-breaking ceremony was organised by the French Space Agency (CNES), with a large contingent of French civilian and military authorities and EU officials in attendance.

Carlo des Dorides, Executive Director of the European GNSS Agency (GSA), the European Union Agency responsible for operating the GSMC, attended the event, "This marks a key step in the development of the Galileo programme", said des Dorides. "The excellent collaboration with France on the GSMC is a positive step for Galileo as well as for Europe."

The GSMC – the future heartbeat of Galileo programme security - will be in charge of several major tasks including: overall management of the system security, management of the Galileo Public Regulated Service (PRS) access, command and control of European GNSS in accordance with the Joint Action, and provision of PRS and GNSS security expertise and analysis. The centre will ensure the reliability of the Galileo system that is crucial for its success. *www.gsa.europa.eu*

Research cruise testing EGNOS satnav for ships

A research vessel surveying European waters is also charting the maritime performance of Europe's EGNOS satnav system. Results gathered by Belgium's RV Belgica are investigating how EGNOS, initially prioritised for aircraft, can also guide marine traffic.

The Belgica is an all-purpose oceanographic research ship that spends around 200 days per year at sea, monitoring the quality of the marine environment, surveying the seabed and serving as a floating laboratory for Belgian universities and research institutes. *www.esa.int*

CEVA and GSN to offer software-based GNSS solutions

CEVA, Inc., a licensor of silicon intellectual property platform solutions and DSP cores, and Galileo Satellite Navigation, Ltd., or GSN, a developer of multi-system global navigation satellite system, or GNSS, receiver technology, have announced a partnership to offer software-based GNSS solutions for the CEVA-XC and CEVA-TeakLite-III DSP platforms.

GSN's software-based approach to satellite receivers enables SoC developers to incorporate advanced GNSS navigation functionality into their designs, with virtually no effect on performance, area and cost, and with no use of hardware acceleration.

Illustrating this, GSN's GNSS receiver consumes 5% of the available MIPS on a CEVA-XC323 DSP, enabling it to run concurrently with a range of other air interfaces on the same processor, including LTE, LTE-Advanced, Wi-Fi and Bluetooth, as well as smart grid protocols. The CEVA-TeakLite-III software-based implementation reportedly enables a cost- and power-efficient GNSS solution for mobile and automotive devices. *www.equities.com*

Interplanetary Society since 2005, recognise notable contributions to the UK space sector. *www.sstl.co.uk*

Saudi Arabia to launch satellites in 2013 and 2015

Saudi Arabian officials have announced that they are preparing to launch several satellites in the next few years as part of a number of different scientific experiments. The satellites will be launched using remote sensing technology, Al-Arabiya reported Prince Turki bin Saud bin Mohammed, vice president of research institutes at the King Abdulaziz City for Science and Technology, as saying. "The most important new satellites are SAUDISAT4, which will be launched in September 2013, and SAUDI GEO1, which will be launched in 2015," he said. *http://al-shorfa.com/en_GB/articles/meii/newsbriefs/2012/11/06/newsbrief-09*

Taking the 'pulse' of volcanoes using satellite images

A new study by scientists at the University of Miami (UM) Rosenstiel School of Marine & Atmospheric Science uses Interferometric Synthetic Aperture Radar (InSAR) data to investigate deformation prior to the eruption of active volcanoes in Indonesia's west Sunda arc. Led by geophysicist Estelle Chaussard and UM Professor Falk Amelung, the study uncovered evidence that several volcanoes did in fact 'inflate' prior to eruptions due to the rise of magma. The fact that such deformation could be detected by satellite is a major step forward in volcanology; it is the first unambiguous evidence that remotely detected ground deformation could help to forecast eruptions at volcanoes. *www.rsmas.miami.edu*

NASA maps how nutrients affect plant productivity

A new analysis led by NASA's Jet Propulsion Laboratory, Pasadena, Calif., has estimated how much the growth of plants worldwide is limited by the amount of nutrients available in their soil. The maps produced from the research will be particularly useful in

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evaluating how much carbon dioxide Earth's ecosystems may be able to soak up as greenhouse gas levels increase.

A research team led by JPL research scientist Josh Fisher used 19 years of data from NASA, NOAA and international satellites to assess the maximum possible growth of vegetation all over the world based upon available water and light conditions. The scientists then cross-compared that potential maximum with observed vegetation productivity as measured by satellites. This is the first time such an analysis has been conducted. *www.jpl.nasa.gov*

MDA and DG to provide ground station solution for USAF program

MacDonald, Dettwiler and Associates Ltd has signed a multi-million dollar contract with DigitalGlobe, Inc. to develop a solution to allow two of the U.S. Air Force's (USAF) mobile ground systems, called Eagle Vision, to receive and process imagery from WorldView-1 and WorldView-2 satellites. MDA's solution will enhance the USAF's ability to provide near real-time in-theatre access to essential image data, on a daily basis. *www.mdacorporation.com*

GOCE's second mission improving gravity map

ESA's GOCE gravity satellite has already delivered the most accurate gravity map of Earth, but its orbit is now being lowered in order to obtain even better results. The Gravity field and steady-state Ocean Circulation Explorer (GOCE) has been orbiting Earth since March 2009, reaching its ambitious objective to map our planet's gravity with unrivalled precision. Although the planned mission has been completed, the fuel consumption was much lower than anticipated because of the low solar activity over the last two years. This has enabled ESA to extend GOCE's life, improving the quality of the gravity model. To be able to measure the strength of Earth's gravity, the satellite was flying in an extraordinarily low orbit about 255 km high – about 500 km lower than most Earth observation satellites. *www.esa.int*

Ancestral domain maps handed over to Indonesian government

Indigenous Peoples' Alliance of the Archipelago (AMAN) and Network for Participatory Mapping (JKPP) have officially handed over ancestral domain map registered in Ancestral Domain Registration Agency (BRWA) to the Indonesia's Geospatial Information Agency (BIG) and Presidential Delivery Unit for Supervision and Control of Development (UKP4). This is the initial handover done by AMAN and JKPP. As a start, being submitted are 265 maps of ancestral domains covering 2,402,222 hectare wide. *http://iccaconsortium.wordpress.com*

Survey of Pakistan to be made national mapping agency

The government has decided to make the Survey of Pakistan into a national mapping agency, according to the draft of a proposed bill. According to the draft bill, the government will detain for at least three months elements damaging the Survey of Pakistan's markings. The Survey of Pakistan is a national mapping organisation is responsible for surveying and mapping requirements of the Armed Forces as well as civilian organisations/ departments. Rapid developments in the field of surveying and mapping, especially computer-aided cartography, availability of satellite imagery and satellite-based GPS have greatly facilitated the art of map making. *www.brecorder.com*

FGDC to develop shared geospatial platform

The Federal Geographic Data Committee of USA is creating a shared geospatial information technology infrastructure for civilian agencies that should reduce the number of single-agency portals. Work on the project, which will include cost-reimbursable cloud services, began earlier this fiscal year, according to Jerry Johnston, Interior Department geospatial information officer. The platform will also give agencies an option to procure cloud-based services for common geospatial system-related functions, including identity management. *www.fiercegovernmentit.com*

Updated maps of Mindanao to be completed soon in Philipines

After a series of validation work that spanned two years, the updated maps of Mindanao that will replace those half a century old versions are set for roll out this year, according to the Mindanao Development Authority (MinDA). In a recent meeting here of the Technical Coordinating Committee for the Mindanao Topographic Mapping Project for Peace and Development, the newly developed topographic maps of Mindanao were presented for final validation by stakeholders. A joint undertaking of MinDA, National Mapping and Resource Information Authority (Namria) and Japan International Cooperation Agency (Jica), the project is designed to produce 1:50,000-scale Mindanao topographic maps, replacing the 1:200,000-scale maps developed in 1960s. *www.sunstar.com.ph*

EU initiative will map cyber repression around the World

The European Union is about to launch "a global monitoring system that will help chart digital repression by mapping the Internet's "cyber geography" in near real time". The idea builds on last year's EU initiative 'No Disconnect', which offers tools and training to activists using the Internet in repressive / authoritarian regimes like Syria. The new initiative will map cyber repression across the world. *http://techpresident.com*

Thailand prevents forest encroachment with GIS map

Thailand's Department of Special Investigation (DSI) has recently introduced 'DSI Map' for wider use among public agencies and citizens across the country to fight against forest encroachment and avoid land conflict in the country. Developed by Map and Geo-Informatics Operation Centre under the DSI's Bureau of Consumer Protection and Environment Crime, it is an online mapping portal created based on data provided by Ministry of Natural Resources and Environment. *www.futuregov.asia*

Twin Otter to explore minerals in State

In a first of its kind, Twin Otter - a Canadian made British Multi Sensor Aircraft would be used for surveying the presence of minerals in Manipur, India particularly in Ukhrul and Chandel district.

The survey in Ukhrul district will cover an area of 1138 square kms extending to places like Nampisha, Yenlem, Gamnom Pushing, Phangrei and Nungpi while in Chandel district, the survey would be conducted covering an area of 293 square kms including places like Leibi, Khudengthabi and Minou, sources disclosed. There have been reports of possible presence of various precious minerals like Platinum, Uranium in Ukhrul district, sources said. *www.e-pao.net*

Singapore pushes for greater GIS collaboration

The Singapore Land Authority (SLA) and Nanyang Polytechnic (NYP) signed an agreement that will push for greater collaboration on geospatial education, training and research and development. The partnership will enable both organisations to tap into each other's expertise and resources in promoting the use of GIS in Singapore. *www.futuregov.asia*

Ghana to have open government data portal by end of 2013

Government is certain to complete an open Government data portal by December 2013 with the implementation of the Ghana Open Data Initiative (GODI) to make Government data available to citizens for re-use. The initiative will make government more transparent, improve efficiency and spark-off innovation from the demand side for applications to be developed to better serve the citizenry. *www.ghanabusinessnews.com*

Tasmania to examine its land management system

The Tasmanian Government has formed a landmark partnership with the nation's GIS specialists for a project expected to set a new national standard in land information management. Together with Esri Australia, the Department of Primary Industries, Parks, Water and Environment (DPIPWE) is overhauling the management of more than 400,000 of the state's cadastral parcels and administrative boundaries to give Tasmanians improved access to accurate, high-quality land information. *http://esriaustralia.com.au*

China, UN Cooperate in Geological Information

The Chinese government and the UN have signed an agreement to jointly promote geological information management. The agreement, known as the cooperation on geospatial information management capacity development, means the Chinese government will invest 4 million U.S. dollars in a UN trust fund, which will be used in projects to strengthen China and other developing countries' capacities of geospatial information production, management and distribution. *http://english.cri.cn*

New earthquake hazard map for Australia

A series of maps depicting areas of Australia which are more or less susceptible to earthquakes will provide important information to help planners mitigate the possible impacts of future earthquakes. The *Earthquake Hazard map of Australia 2012* has been developed by seismologists at Geoscience Australia following investigations into the continent's earthquake history. *www.ga.gov.au*

Vietnam to build land data system

The Korean International Cooperation Agency (KOICA) will be collaborating with the Vietnamese Government to set up a multi-purpose land data management system starting next year. The initiative comes as a response to an increasing demand for land information at all levels of government. *www.futuregov.asia*

Nokia acquires Earthmine

Nokia has acquired 3D-mapping company Earthmine. Moving quickly, the struggling mobile firm has launched a new free location cloud service called Here, available at the URL Here. net. Nokia is pushing its mapping unit hard with the introduction of the new cloud-based location brand and platform. *http://thenextweb.com*

Augmented reality apps may generate USD 300 mn in 2013

According to a report by 'Mobile Augmented Reality: Entertainment, LBS & Retail Strategies 2012-2017', about 2.5bn AR apps are expected to be downloaded to smartphones and tablets per year by 2017.Out of the total AR apps downloaded, games will account for the largest share, though the traditional pay-per-download payment model would continue to account for the largest share of revenues in the medium term.

There will be further growth avenues, with AR increasingly being deployed in prototype wearable devices like Google Glass. Key hurdles in the growth could be lack of consumer awareness while technological limitations of AR-enablers such as the phone camera, GPS, digital compasses and markerless tracking leads to AR failing to live up to consumer expectations. *http://mobility.cbronline.com*

Yandex rolls into Europe, U.S. With Digital Mapping Expansion

Hot on the heels of launching its own Internet browser and an Android app store to build out its business and keep Google at bay in its home territory, Russian search engine Yandex has quietly extended the reach of its digital mapping service — launching international maps for Europe and the U.S. The maps are powered by Navteq mapping data which Yandex licensed back in January, and can be accessed at maps. yandex.com. *http://techcrunch.com*

Thomson Reuters launches interactive map

Thomson Reuters has announced that it has added an interactive map for monitoring the impact of weather, natural disasters and political events on commodity production and freight to its flagship desktop, Thomson Reuters Eikon. Interactive Map allows commodity markets professionals to use innovative visualization tools to track the global movement and production of key commodities in real-time and forecast the influence of important impact factors upon supply and demand and, ultimately, market prices. *http://thomsonreuters.com*

China Mobile LBS Has over 20mn Users

The location based service (LBS) of China Mobile Ltd. one of the company's nine major SP businesses, has grasped over 23 million users. Moreover, the service has also collected over 8 million pieces of information about places throughout China which users may get interested in. China Mobile has nine major business bases. The LBS base was founded in Liaoning in 2006 and is mainly engaged in the support, R&D and promotion of specialized LBS service and basic location abilities. *www.sina.com.cn*

XcelMobility deploys New Location Based Product

XcelMobility has signed a contract for the deployment of its advanced LBS product through an agreement with the Hubei GIS Center, China, which offers services to many of the over 57 million citizens of the province as well as to numerous enterprise subscribers located both regionally and nationally. The new Mach5 LBS product for advanced location based applications and services have been positioned as a significant all-new revenue stream for the growing Company. Its location based service offers developers and businesses a user friendly method to easily add advanced location capabilities to their mobile apps. *www.xcelmobility.com*

MARK YOUR CALENDAR

January 2013

9th Annual Geospatial Intelligence Conference and Exhibition
21-23 January
QEII Conference Centre, London
www.geoplace.com

ION International Technical Meeting
27 – 29 January
San Diego, California, United States
http://ion.org/meetings/

February 2013

Second High Level Forum on Global Geospatial Information Management
4-6 February
Doha, Qatar
http://ggim.un.org/

The International LiDAR Mapping Forum
11-13 February
Colorado, USA
www.lidarmap.org

ACSER
19 February
Sydney,Australia
www.acser.unsw.edu.au/oemf/workshop.html

The Munich Satellite Navigation Summit 2013
26 – 28 February
Munich Germany
www.munich-satellite-navigation-summit.org

March 2013

ASPRS 2013 Annual Conference
24 – 28 March
Baltimore, Maryland USA
www.asprs.org

April 2013

Annual World Bank Conference on Land and Poverty 2013
8 - 11 April
World Bank Headquarters,
Washington, D.C., USA
www.landandpoverty.com

The Eighth National GIS Symposium in Saudi Arabia
15-17 April
Dammam, Saudi Arabia
www.saudigis.org/

7th Annual GNSS Vulnerabilities and Solutions Conference
18 - 20 April
Baska, Krk Island, Croatia
www.rin.org.uk

UN/Croatia Workshop on GNSS Applications
21 - 25 April
Baska, Krk Island, Croatia
www.unoosa.org/oosa/SAP/gnss/index.html

Pacific PNT
22-25 April 2013
Honolulu, Hawaii
www.ion.org

35th International Symposium on Remote Sensing of Environment
22 - 26 April
Beijing, China
http://www.isrse35.org

European Navigation Conference ENC 2013
23 -25 April
Vienna, Austria
www.enc2013.org

The 7th International Satellite Navigation Forum
24 – 27 April
Moscow, Russia
http://www.expocentr.ru/en/events/glon

May 2013

Intergeo East 2013
2 – 4 May
Istanbul, Turkey
http://www.intergeo-east.com/

The 8th International Symposium on Mobile Mapping Technology
1-3 May
National Cheng Kung University, Tainan
http://conf.ncku.edu.tw/mmt2013/

FIG Working Week 2013
6–10 May
Abuja, Nigeria
www.fig.net/fig2013/

The 4th China Satellite Navigation Conference
15-17 May
Wuhan, China
www.beidou.gov.cn

June 2013

Hexagon 2013
3- 6 June
Las Vegas, USA
http://www.hexagonmetrology.us

12th SEASC – Geospatial Cooperation towards a sustainable future
18 - 20 June
Manila, Philippines
www.seasc2013.org.ph

TransNav 2013
19 - 21 June
Gdynia, Poland
http://transnav2013.am.gdynia.pl

July 2013

International Geoscience and Remote Sensing Symposium (IGARSS 2013)
22-26 July
Melbourne, Australia
www.igarss2013.org

August 2013

8th International Symposium on Digital Earth 2013 (ISDE 2013)
26-29 August
Kuching, Sarawak, Malaysia
http://isde2013.utm.my/

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